

# THE LIVING AGE.

No. 1030.—27 February, 1864.

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NEW YEAR'S PRESENTS TO CLERGYMEN.—Our text will be found on the front of several of the late Nos.; but we now ask our readers to apply it to a single class of persons, while the price of every article of food or clothing, and of all the necessaries of life (excepting *The Living Age*), has been increased, little or nothing has been done to raise proportionally the salaries of clergymen. They are obliged to lessen their comforts, in order to meet this pressure.

Reader, if you wish to refresh the mind and the heart of the man who "ministers to you in holy things," present him with mental food once a week, and do not give him *The Living Age* if there be any other work that will do him more good.

ADVANCE IN THE PRICE OF BINDING.—The Covers for *The Living Age* are made up of Cotton Cloth and Pasteboard; and the manufacturers advanced their prices—nearly doubled them—some time ago. We ought then to have increased our charge for binding, but neglected to do so. But for all Volumes bound by us after the 15th of March, the price will be sixty-five cents.

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## "FAR AWAY."

"The land that is very far off."—*Isaiah* 33: 17.

Upon the shore  
Of Evermore  
We sport like children at their play;  
And gather shells  
Where sinks and swells  
The mighty sea from far away.

Upon that beach,  
Nor voice nor speech  
Doth things intelligible say;  
But through our souls  
A whisper rolls  
That comes to us from far away.

Into our ears  
The voice of years  
Comes deeper, deeper, day by day;  
We stoop to hear,  
As it draws near,  
Its awfulness from far away.

At what it tells  
We drop the shells  
We were so full of yesterday,  
And pick no more  
Upon that shore,  
But dream of brighter far away.

And o'er that tide,  
Far out and wide,  
The yearnings of our souls do stray;  
We long to go,  
We do not know  
Where it may be, but far away.

The mighty deep  
Doth slowly creep  
Up on the shore where we did play;  
The very sand  
Where we did stand  
A moment since, swept far away.

Our playmates all  
Beyond our call  
Are passing hence, as we, too, may;  
Unto that shore  
Of Evermore,  
Beyond the boundless far away.

We'll trust the wave,  
And Him to save  
Beneath whose feet as marble lay  
The rolling deep,  
For he can keep  
Our souls in that dim far away.

—*Fraser's Magazine*.

## MISTS.

WHEN, o'er the smiling landscape spread,  
The misty vapors rise,  
And Nature's lovely face is veiled  
Reluctant from our eyes:  
E'en as we mourn the picture fled,  
Uprising in his might,  
The glowing sun the fog repels,  
And, bathed in floods of light,

Again to our enraptured gaze,  
Each varying charm unfolds;  
Whilst heaven-sent melody of birds  
Entranced our senses holds.

Thus, when, to steadfast eye of Faith,  
The mists of doubt and fear  
Enshroud in dark obscurity  
The prospect bright and clear,

The Sun of Righteousness will shine,  
With his all-powerful ray—  
Will banish hence the shadowy gloom,  
Till perfect reigns the day!

F. DRIVER.

—*National Magazine*.

## A CHRISTMAS CAROL.

1863.

If ye would hear the angels sing,  
"Peace on earth, and mercy mild,"  
Think of Him who was once a child,  
On Christmas-day in the morning.

If ye would hear the angels sing,  
Christians! See ye let each door  
Stand wider than ever it stood before,  
On Christmas-day in the morning.

Rise, and open wide the door;  
Christians, rise! the world is wide,  
And many there be that stand outside,  
Yet Christmas comes in the morning.

If ye would hear the angels sing,  
Rise and spread your Christmas fare;  
'Tis merrier still the more that share,  
On Christmas-day in the morning.

Rise, and bake your Christmas bread.  
Christians, rise! the world is bare,  
And bleak and dark with want and care,  
Yet Christmas comes in the morning.

If ye would hear the angels sing,  
Rise and light your Christmas fire;  
And see that ye pile the logs still higher,  
On Christmas-day in the morning.

Rise, and light your Christmas fire;  
Christians, rise! the world is old,  
And Time is weary and worn and cold,  
Yet Christmas comes in the morning.

If ye would hear the angels sing,  
Rise and spice your wassail-bowl  
With warmth for body and heart and soul,  
On Christmas-day in the morning.

Spice it warm, and spice it strong.  
Christians, rise! the world is gray,  
And rough is the road, and short is the day,  
Yet Christmas comes in the morning.

If ye would hear the angels sing,  
Christians! think on Him who died;  
Think of your Lord, the Crucified,  
On Christmas-day in the morning.

DORA GREENWELL.

—*Good Words*.

From The Edinburgh Review.

1. *Heat considered as a Mode of Motion; being a Course of Twelve Lectures delivered at the Royal Institution of Great Britain in the Season of 1862.* By John Tyndall, F.R.S. London: 1863.
2. *On the Mechanical Equivalent of Heat.* By J. P. Joule, LL.D., F.R.S. "Philosophical Transactions," 1850, Part I. p. 61. London.
3. *On Celestial Dynamics.* By Dr. J. R. Mayer, of Heilbronn. "Philosophical Magazine," 4th Series, Vol. XXV. p. 241. London, Dublin, and Edinburgh.

MR. SMILES relates, in his *Lives of the Engineers*, that George Stephenson one day said to Dr. Buckland, as a train passed in front of Tapton House, "Now, Buckland, I have a poser for you. Can you tell me what is the power that is driving that train?" "Well," said the other, "I suppose it is one of your big engines." "But what drives the engine?" "Oh, very likely a canny Newcastle driver." "What do you say to the light of the sun?" "How can that be?" asked the doctor. "It is nothing else," said the engineer; "it is light bottled up in the earth for tens of thousands of years—light absorbed by plants and vegetables, being necessary for the condensation of carbon during the process of their growth; and now, after being buried in the earth for long ages in fields of coal, that latent light is again brought forth and liberated, made to work, as in that locomotive, for great human purposes. This observation, made by the father of the railroad system, strange though it may at first sight appear, is literally accurate: it is an ingenious deduction from a grand expression of Nature's truth lately perceived by scientific men, and now known under the name of the "Mechanical or Dynamical Theory of Heat." This theory is not merely valuable as giving us correct views of the nature of this all-pervading and life-sustaining principle of heat, it likewise leads to the discovery of a far wider and more important set of truths, all tending to the conclusion that the great agencies Heat, Light, Electricity, Magnetism—which uphold life and produce such colossal changes on our globe—are but the expressions in different languages of one great power; that these various forms of energy are mutually convertible; that we can express any one of them in the terms of any other; and, therefore, that a certain quantity of the one form

is equivalent to or may be made to produce a given quantity of another form. The mechanical theory of heat declares that heat has no existence independently of matter—that what we call heat is only a peculiar condition of matter, viz., "a vibration of its ultimate particles:" so that, as heat is nothing but motion, we can measure heat, as we measure common mechanical energy, by a weight falling through a given space. Nor is this all that this "New Philosophy," as Professor Tyndall rightly calls it, teaches us; for it further shows by virtue of the convertibility of these "imponderables," as they have been termed, and owing to the possibility of expressing each of these in terms of common mechanics, that the destruction or creation of energy in the world is just as impossible as the creation or destruction of matter itself.

In the history of physical science, as in the history of nations, sudden revolutions mark great events which stand out conspicuous above the ordinary quiet progress of the day. Such a revolution was effected in the world of science by Lavoisier's introduction of the balance into chemistry, for it thereby became evident that man can neither create nor destroy matter; so that, for instance when a candle burns, the substance of the candle is not lost or destroyed, but has simply become insensible to our powers of vision. A second and equally important revolution in science has recently been effected by the adoption of the New Philosophy of the Mechanical Theory of Heat, experimentally founded, as we shall see, by Dr. Joule of Manchester, on the leading principle of the "Conservation and Indestructibility of Energy."

In order that we may understand the full meaning and appreciate the wide scope of this grand principle, we must proceed to consider some of the fundamental experiments upon which this most recent of the brilliant results of modern science is based; remembering that it is only from "questions thus put to Nature" that we can hope to gain any knowledge of her secrets.

The first branch of science in which the principle of the conservation of energy became apparent is mechanics; and it has long been well known that labor cannot be effected without a corresponding expenditure of mechanical energy. The "mechanical powers," as they are termed, are simply means for transferring labor into any wished-

for channel. No *augmentation* of labor can be effected by them; for, although by means of a small weight at the long end of a lever we can raise a heavier weight, say a weight ten times as large, placed at the other end, the space through which the small weight must pass is at least ten times as great as that through which the heavy weight is raised; and hence there is clearly no augmentation of power. The true expression of the power exerted is invariably the weight multiplied into the distance through which it falls. This is called the "laboring force"—the force which produces results, which overcomes resistance; and the great principle in mechanics is expressed in the maintenance of this law—that by means of any machine no effects can be produced which exceed the laboring force of the motive power. This, then, is the true measure for mechanical work. To raise ten pounds through the space of one foot requires a given expenditure of power; twice that amount of power must be expended in raising it through two feet, and the same amount of power will be required to raise ten pounds through one foot as will be needed to raise one pound through ten feet. Every kind of mechanical work, whether done by machine or animal power, can be represented and measured by weights raised through given spaces; and the unit of measurement and mechanical work is taken to be the weight of one pound raised through the space of one foot. The quantity of mechanical power necessary to effect this work is termed a "foot-pound."\* The principle of the conservation of energy as regards ordinary mechanics was completely and mathematically stated by Newton, and a proof was thus given of the absurdity of the long-sought-for *perpetuum mobile* at least in mechanical contrivances.

However apparent it may be that action and reaction are equal and opposite in the domain of strictly mechanical forces, the wider application of the same law to the manifestation of the other powers of nature seems by no means so clear. Could we not, it may be asked, by help of heat, electricity, or some such occult force, construct a ma-

chine which will produce mechanical effect without any corresponding or equivalent expenditure of labor, and thus attain the greatly desired end of making something out of nothing? In fact, have we not such a machine in the steam-engine? Where are we to find in this machine the expenditure of labor equivalent to the work done? In the water-wheel we have, in the descending water, an evident mechanical equivalent for the work done; but in the steam-engine, if the condensation were perfect, we may imagine that the position of all parts of the machine, and of the water used for the production of steam, is precisely the same at the end as it was at the beginning of the stroke of the piston.

To question such as these the new philosophy gives a definite and satisfactory answer, proving, as clearly as Newton did in mechanics, that by the employment of *none* of the powers of nature can work be done without a corresponding supply of energy of some kind. Thus in the steam-engine we find the source of necessary power in the heat which disappears in the cylinder; the amount of heat which the waste steam conveys into the condenser not being nearly as much as that which enters the cylinder, the difference between the two amounts is converted into mechanical action. So that at last we come to the conclusion that, with whatsoever forces of nature we operate, a *perpetuum mobile* cannot be constructed—that we cannot by any means whatever produce an effect without a consumption of some kind of power. What follows from this important conclusion? What do we mean when we say that a *perpetuum mobile* is impossible? We mean that there is no such thing in nature as a creation of force; that all the changes which we see going on around us are produced solely by the transference of force; and hence force cannot be destroyed any more than matter. We may sum up these results in the words of Mr. Grove, an early and able expounder of these views: "In all phenomena, the more closely they are investigated, the more we are convinced that, humanly speaking, neither matter nor force can be created or annihilated, and that an essential cause is unattainable. Causation is the will, creation the act of God."

Although the idea that heat is nothing more than motion has frequently been expressed by various writers even in remote

\* In almost all scientific works the French standards of weight and length are now employed; and as these units will probably before long come into general use in England, it may be well to remember that the French standard of a kilogramme-metre—viz., the weight of a kilogramme raised through the space of one metre—is equal to 7.23 foot-pounds.

times, opinions to the contrary have been upheld by some men of science within a recent period, and it is only during the last few years that the dynamical theory of heat, in opposition to the material or emission theory, has received the universal assent of the scientific world. Aristotle seems to have held the belief that heat was motion, and Locke expressed the same view concisely as follows: "Heat is a very brisk agitation of the insensible parts of the object, which produce in us that sensation from whence we denominate the object hot; so that what in our sensation is heat in the object is nothing but motion." Bacon, too, held similar views, and in the 2nd Book of the "*Novum Organum*" he writes, "heat itself, its essence and quiddity, is motion and nothing else." Lavoisier and Laplace, in their memoir on heat published in 1780, express the modern doctrine most exactly: "*D'autres physiciens,*" say they, "*pensent que la chaleur n'est que le résultat des vibrations insensibles de la matière. . . . Dans le système que nous examinons, la chaleur est la force vive qui résulte des mouvements insensibles des molécules d'un corps; elle est la somme des produits de la masse de chaque molécule par le carré de sa vitesse.*"

The expression of these views, however near the truth they may have been subsequently found to be, exerted but little influence on the progress of science, because they were totally unsupported by experimental evidence, without which such views must remain all but valueless speculations. Building upon a more secure foundation than the older philosophers, the modern man of science carefully collects and employs even the smallest fact regarding the subject which he is investigating; and, not content with the mere observation of the phenomena under the conditions in which they occur in nature, he endeavors to attain a more intimate knowledge of his subject by examining what takes place under other conditions over which he has control—he has, in short, recourse to experiment.

Let us, then, follow Dr. Tyndall in the description of the experimental evidence which he brought forward at the Royal Institution two years ago, to impress upon the minds of his hearers the truth of the mechanical theory of heat; the result will enable us to judge of the success of his attempt "to bring the rudiments of a new philosophy within the reach

of a person of ordinary intelligence and culture." The first part of the work consists in a lucid exposition of the facts upon which the mechanical theory of heat is founded; in describing these, and the consequences derived from them, Dr. Tyndall claims simply to be heard as an expounder of the results obtained by other philosophers; in the later portion of the work he describes the results of his own researches as an original investigator in the regions of physical science. The readers of the book will see that in both these capacities the author shows his power, and we regret that our space does not permit us to enter more fully upon the discussion of those portions of the lectures in which he brings forward his own discoveries.

"My desire," says Dr. Tyndall, in his first lecture, "now is to connect heat with the more familiar forms of force; and I will therefore, in the first place, try to furnish you with a store of facts illustrative of the generation of heat by mechanical processes. I have placed some pieces of wood in the next room, which my assistant will now hand to me. Why have I placed them there? Simply that I may perform my experiments with that sincerity of mind and act which science demands from her cultivators. I know that the temperature of that room is slightly lower than the temperature of this one, and that hence the wood which is now before me must be slightly colder than the face of the pile\* with which I intend to test the temperature of the wood. Let us prove this. I place the face of the pile against this piece of wood; the red end of the needle moves from you towards me, thus showing that the contact has chilled the pile. I now carefully rub the face of the pile along the surface of the wood: mark what occurs. The prompt and energetic motion of the needle towards you declares that the face of the pile has been heated by this small amount of friction. These experiments, which illustrate the development of heat by mechanical means, must be to us what a boy's school exercises are to him. In order to fix them in our minds, and obtain due mastery over them, we must repeat and vary them in many ways. In this task I must ask you to accompany me. Here is a flat piece of brass with a stem attached to it; I take the stem in my fingers, preserving the brass from all contact with my warm hand by enveloping the stem in cold flannel. I place

\* An instrument called a thermo-electric pile or battery, which serves as a very delicate indicator and measure of change of temperature, and was used by Dr. Tyndall to render the results of the experiment apparent to a large audience.

the brass in contact with the face of my pile; the needle moves, showing that the brass is cold. I now rub the brass against the surface of this cold piece of wood, and lay it once more against my pile. I withdraw it instantly, for it is so hot that, if I allowed it to remain in contact with the instrument, the current generated would dash my needle violently against its stops, and probably derange its magnetism. You see the strong deflection which even an instant's contact can produce. Here also is a razor, cooled by contact with ice; and here is a hone without oil, along which I rub my cool razor as if to sharpen it. I now place the razor against the face of the pile, and you see that the steel which a minute ago was cold is now hot. . . . These are the simplest and most commonplace examples of the generation of heat by friction, and I choose them for this reason. Mean as they appear, they will lead us by degrees into the secret recesses of nature, and lay open to our view the polity of the material universe." —Tyndall, pp. 5. 6.

Dr. Tyndall then illustrates the production of heat by compression and percussion; he shows that a piece of wood squeezed forcibly in an hydraulic press becomes hot, and that a leaden bullet is heated when flattened by a cold sledge-hammer.

"The sledge," he continues, "descends with a certain mechanical force, and its motion is suddenly destroyed by the bullet and anvil. But let us examine the lead; you see it is heated, and could we gather up all the heat generated by the shock of the sledge, and apply it without loss mechanically, we should be able by means of it to lift this hammer to the height from which it fell. When a hammer strikes a bell the motion of the hammer is arrested, but its force is not destroyed; it has thrown the bell into vibrations which affect the auditory nerve as sound. So, also, when our sledge-hammer descended upon our lead bullet, the descending motion of the sledge is arrested; but it was not destroyed. *Its motion was transferred to the atoms of the lead, and announced itself to the proper nerves as heat.*" —Tyndall, p. 7.

Heat is not merely produced by the friction of solid bodies; the friction or motion of liquids likewise generates heat; whenever, in fact, the motion of matter is retarded or stopped, heat is developed. Thus, if water be agitated it becomes warmer; every drop of rain having fallen is warmer than it was before; and the water at the bottom of a cataract is of a higher temperature than the

water above the fall: so that, as Dr. Tyndall remarks, the sailor's tradition is theoretically correct, that the sea is rendered warmer through the agitation produced by a storm, the mechanical dash of the billows being ultimately converted into heat. The increase of temperature thus effected is but very slight, and requires delicate thermometers for its recognition; nevertheless, the amount is perfectly definite, and can be exactly foretold, if we know the weight of falling water and the distance through which it falls. The fact that heat is developed by falling liquids may be rendered evident by pouring mercury several times backwards and forwards from two cups; at the end of the operation the temperature of the mercury is seen to be higher than it was before.

"Whenever friction is overcome, heat is produced, and the heat produced is the measure of the force expended in overcoming the friction. The heat is simply the primitive force in another form, and if we wish to avoid this conversion we must abolish the heat. We usually put oil upon the surface of a hone, we grease a saw, and are careful to lubricate the axles of our railway carriages. What are we really doing in these cases? Let us get general notions first; we shall come to particulars afterwards. It is the object of a railway engineer to urge his train bodily from one place to another; he wishes to apply the force of his steam, or of his furnace which gives tension to his steam, to this particular purpose. It is not his interest to allow any portion of that force to be converted into another form of force which would not further the attainment of his object. He does not want his axles heated, for, for every degree of temperature generated by the friction of his axles, a definite amount would be withdrawn from the urging force of his engine. There is no force lost absolutely. Could we gather up all the heat generated by the friction, and could we apply it all mechanically, we should by it be able to impart to the train the precise amount of speed which it had lost by the friction. Thus, every one of those railway porters whom you see moving about with his can of yellow grease, and opening the little boxes which surround the carriage axles, is, without knowing it, illustrating a principle which forms the very solder of nature. In so doing, he is unconsciously affirming both the convertibility and the indestructibility of force. He is practically asserting that mechanical energy may be converted into heat, and that when so converted it cannot still exist as mechanical energy, but that for every degree of

heat developed, a strict and proportional equivalent of the locomotive force of the engine disappears. A station is approached, say at the rate of thirty or forty miles an hour; the brake is applied, and smoke and sparks issue from the wheel on which it presses. The train is brought to rest. How? Simply by converting the entire moving force which it possessed at the moment the brake was applied into heat."—Pp. 8-10.

The first person who made definite experiments upon the conversion of mechanical energy, or motion of the masses, into heat, or motion of the particles, was Count Rumford,\* a very remarkable man, more generally known as the inventor of cheap, wholesome food for soldiers than as an investigator of natural science—for thus it often happens that the chief labors of a man's life remain long or forever unknown, his fame resting upon an achievement which he himself considered trivial, and to which he at the time gave no concern.

Rumford, being engaged at Munich in boring cannon, was so forcibly struck with the great amount of heat generated by the process, that he constructed an apparatus for the special purpose of examining the development of heat by friction, and, in a most interesting paper, he presented the results of his experiments to the Royal Society in the year 1798. In this paper he proposes to himself to answer the following questions: Whence comes the heat actually produced in the mechanical operation above alluded to? Is it furnished by the metallic chips which are separated from the metal? The production of heat by friction or percussion was always a difficulty with the upholders of the material theory of heat. They got over it, however, by saying that the "capacity for heat" of the hammered bullet, or metallic chip, is less than that of the metal before it was submitted to these mechanical actions, and therefore, as it was unable to contain so much heat, its temperature was raised. This difference between bodies as regards their "capacities for heat" has indeed a real existence; thus, for example, if we take the two liquids, wa-

ter and mercury, and warm a pound of each of these, from fifty degrees to sixty degrees Fahrenheit, by pouring in boiling water, we shall find that the quantity of hot water which we have to add to the pound of cold water is fully thirty times as great as that which must be added to the pound of cold mercury, in order to effect a change of ten degrees in the temperature of each of these liquids. Hence the water is said to have a greater "capacity" for heat than mercury: a given quantity of heat does not go so far in heating the water as the mercury. Rumford, however, showed that the chips cut from his cannon did not change their capacity for heat, and further asks if it is conceivable that all the heat he obtained by his boring could be squeezed out of so inconsiderable a quantity of metallic dust. The description which this philosopher gives of his experiment is an agreeable change for the reader of the usually heavy science of the "Philosophical Transactions." Having stated that he placed 18 3/4 pounds of water having the temperature of sixty degrees Fahrenheit round his gun, into which he bored a hole by means of horse-power, he informs us that after the boring had continued for two hours and twenty minutes the water attained the temperature of two hundred degrees, and in ten minutes afterwards "it actually boiled!" He then goes on to say—

"It would be difficult to describe the surprise and astonishment expressed by the bystanders on seeing so large a quantity of water heated, and actually made to boil, without any fire. Though there was nothing that could be considered very surprising in this matter, yet I acknowledge fairly that it afforded me a degree of childish pleasure which, were I ambitious of the reputation of a grave philosopher, I ought most certainly rather to hide than to discover."

And here we would most heartily endorse Dr. Tyndall's remark, that the application of any philosophy which should stifle such emotion as Rumford avowed may indeed well be dispensed with; for surely, one of the highest of intellectual gratifications is that which the man of science enjoys when, as the result of laborious experiment, a new unperceived truth flashes across his mind, rendering the path through which he has been perhaps long and darkly wandering as clear as noonday.

An interesting experiment made by Sir

\* Rumford was by birth an Anglo-American, his family name being Benjamin Thompson; he served in the war of independence on the British side; he then became minister of war to the Elector of Bavaria, by whom he was ennobled, and afterwards settled as a man of science in Paris, having married the widow of the great Lavoisier.

Humphrey Davy in the year 1799 may now be cited, as it has frequently been regarded as the first proof of the immateriality of heat. Davy took two pieces of ice, and placing them in a room the temperature of which was below the freezing point (thirty-two degrees Fahrenheit), he rubbed one piece of ice upon the other, arranging his apparatus so that no external heat could reach the ice. He found that by the friction of the two pieces, on each other the ice was melted, the temperature of the melted water rising to thirty-five degrees. Now ice is simply solid water, and, as it possesses only half the capacity for heat of liquid water, the quantity of heat which raises one pound of liquid water one degree, will raise the temperature of a pound of ice two degrees. Besides, water in passing from the solid to the liquid state takes up a vast quantity of heat, which becomes so hidden or latent as to be imperceptible to the thermometer: so that, as liquid water at thirty-two degrees contains much more heat than solid water (ice) at the same temperature, it is clear that, when the ice was melted by friction, a generation and not a transference of heat must have occurred, for it cannot be said that the heat hidden in the ice is merely rendered sensible, inasmuch as the quantity is only a small fraction of the heat contained in the water. Hence Davy concludes that "the immediate cause of the phenomenon of heat is motion, and the laws of its communication are precisely the same as the laws of the communication of motion." If, as it would appear, heat be nothing more than motion, either of the ultimate particles of matter, or of the so-called "luminiferous ether" (and it matters not for our present purpose which of these proves to be the case), it must be possible to produce the effect of cold by bringing together two rays of heat, just as the vibrations of the ether producing light may be made to interfere and neutralize each other and two rays of light thus produce darkness, or as two balls of clay, when moving with equal velocity in opposite directions, on meeting remain at rest. The experimental proof of this deduction was given by two French philosophers, MM. Fizeau and Foucault, and thus the chain of evidence of the immateriality of heat was riveted more firmly than ever.

Having convinced ourselves of the truth of the mutual convertibility of mechanical en-

ergy and heat, we now pass to quantitative considerations, and ask what relation exists between a given quantity of heat and the mechanical energy which will produce it? How much labor can we get out of a certain quantity of heat, or *vice versa*? It is obvious that this must be a fixed quantity. We cannot make a given amount of friction produce more than a certain amount of heat, otherwise we should admit the possibility of a *perpetuum mobile*; and the invariable character of the great laws of nature would lead us to predict that this amount is always constant, and that a given quantity of heat, neither more nor less, is always produced by a certain amount of mechanical energy, from what source soever that energy may be derived. The first person who clearly saw that the only mode of proving the truth of this great principle must be by a direct appeal to exact and extended experiments, and had at the same time the power successfully to grapple with so intricate and laborious a subject, was Dr. Joule, of Manchester. It is to Joule that science will ever remain indebted for the numerical determination of the *mechanical equivalent of heat*; and although other philosophers have, as we shall see, done much to extend and develop the subject, yet without Joule's practical labors the theory would have been destitute of any firm experimental basis, and therefore unworthy of our acceptance as a sound addition to science. The magnitude and importance of his investigations cannot, therefore, be over-estimated; nor can we refrain from expressing our admiration for the man who could unaided, for seven years, devote his whole energies to the establishment of this important principle, in spite of difficulties and discouragements of no ordinary kind. Dr. Joule determined experimentally the quantity of heat which was evolved by the friction of various substances produced by measurable forces, such as given weights falling through a given space. He measured the heat evolved in water by stirring it with paddles, by the expenditure of a known amount of labor; he did the same with sperm-oil and mercury: he then measured the heat produced when two discs of iron were rubbed against one another, and he likewise determined the heat evolved in the passage of liquids through capillary tubes by friction against the walls of the tubes. These experiments, repeated and controlled in a variety of ways, proved

that in every case the *absolute quantity of heat* generated by a given quantity of mechanical energy is definite and invariable, whether that energy be used to stir water, to rub iron, or to do any other kind of work. The numerical results of Joule's most refined experiments showed that, if the weight of one pound fall through a space of seven hundred and seventy-two feet, exactly sufficient heat is generated to raise the temperature of one pound of water one degree of Fahrenheit's thermometer; and that if, conversely, we change heat into mechanical power, the quantity of heat capable of raising the temperature of one pound of water one degree is exactly able to produce mechanical energy sufficient to raise a weight of one pound through the space of seven hundred and seventy-two feet. This number then is called the *mechanical equivalent of heat*; and it constitutes the foundation-stone of the science of thermo-dynamics. Previously to these discoveries, Joule had ascertained that this same quantity of heat was evolved by the expenditure of the above amount of mechanical energy applied to work a magneto-electric engine, in which the electricity was changed to heat, and also when the same labor is employed in compressing air; thus proving that the same equivalent holds good for the most diverse forms of mechanical action.

A knowledge of the mechanical equivalent of heat enables us to calculate the temperature which a cannon-ball will attain if, when moving with a given velocity, its course is suddenly stopped by a target, as well as the heat which would be liberated by the arrest of the earth in her orbit. This latter calculation has been made, and we learn from it that the quantity of heat liberated by the shock of the stoppage would not only be sufficient to melt the whole earth, but to reduce the greater portion to the state of vapor; and that to develop the same amount of heat by combustion, it would be necessary to burn fourteen globes of coal each as large as the earth; whilst, if the earth were then to fall into the sun, the heat generated by the gigantic blow would be equal to that given off by the burning of 5,600 worlds of pure carbon! So enormous indeed is the amount of heat generated by the stoppage of rapidly falling bodies, that it has caused many scientific men, as originally proposed by Dr. Joule, of Manchester, to speculate upon the "grand

secret," as Sir W. Herschel calls it, of the power supporting the vivifying radiation of light and heat which the sun continually pours out upon the universe. The amount of this heat and light which emanates from the sun is so enormous that the mind fails altogether to grasp the idea. It has, however, been calculated that out of 2,300 millions of parts of light and heat emitted by the sun, the earth only receives one part; whilst the whole heat radiated from the sun in one minute has been found by Sir John Herschel to be sufficient to boil twelve thousand million cubic miles of ice-cold water! How, we may ask with Dr. Tyndall, is this enormous loss made good? Whence is the sun's heat derived and by what means is it maintained? It cannot be kept up by ordinary combustion, for if the sun were a solid lump of coal it would be burned out in 4,600 years; whereas, geology teaches us in every page that the sun shone on our earth hundreds of thousands of years ago as it does at the present day. The philosophers who have speculated upon this great question show, that if a meteorite or asteroid were to fall into the sun with the greatest velocity which it is capable of acquiring, it would, on falling, engender a quantity of heat nearly ten thousand times as great as that which would be developed by the combustion of an equal weight of coal. These meteorites are known to fall upon the earth in certain seasons in large numbers, but the heat developed by them is small, owing to the comparatively slight velocity which they attain before reaching so small an attracting mass as that of the earth. Now astronomers seem to think it probable that the lens-shaped mass, termed by us the zodiacal light, which surrounds the sun, consists of a vast collection of such asteroids; these moving, like the planets, in a resisting medium must approach the sun, and on showering down upon the sun's surface transfer their motion into heat; thus maintaining the temperature of the sun, and therefore sustaining life on our planet. The quantity of matter which would thus have to be added to the sun's body, in order to replace the heat lost by radiation, is so insignificant in comparison to its bulk that it would not have altered the apparent size of the sun during the historical period. If our moon fell into the sun, it would only develop heat enough to make good

one or two years' loss; and were the earth to fall into the sun, the necessary heat would be supplied for nearly a century.

It is a question, however, if the augmentation in the sun's attraction which this theory presupposes would not have been observed by astronomers even after the lapse of some few years. Whether this will turn out to be the true explanation of the maintenance of solar heat, we know not; but, at any rate, a sun might thus be formed, and the theory serves as an illustration of the application of thermodynamics to cosmical phenomena.

That the general progress of scientific discovery is to a great extent independent of the labors of particular individuals, is rapidly becoming an accepted axiom. At any given period of the world's history, many of the foremost minds become independently imbued with the same or similar ideas, and these find expression through one or more of these gifted persons, who, owing to some special qualifications, are adapted to be the mouth-piece of the time, and clearly put forward views more or less imperfectly shadowed forth by others. This aspect of scientific progress by no means lowers the dignity or value of individual effort. We do not prize the results of Newton's genius less because we feel that, even if he had never lived, science, through the labors of others, would probably in course of time have attained its present position; nor shall we undervalue the great additions to knowledge granted to us by the investigations of Dr. Joule, because other philosophers have expressed views similar to those the correctness of which he has so successfully proved by a direct appeal to experiment. Almost every great discovery has been independently arrived at by several persons. One investigator works out his subject more fully and carefully than another; but the idea generally starts into several minds at once. In illustration of this fact, we need only mention the simultaneous discovery of the differential calculus by Newton and Leibnitz, or the great controversy respecting the discovery of the composition of water by Cavendish, Watt, and Lavoisier; or, again, that concerning the discovery of the safety-lamp by Davy and George Stephenson. Hence arises a difficulty which the historian of science will always have to contend with; the difficulty, namely, of rightly adjudging the questions of scientific priority. An interesting, though unnecessarily acrimonious, dis-

cussion of this kind has lately taken place in the pages of the *Philosophical Magazine*, between Dr. Tyndall and Professors William Thomson and Tait of Glasgow and Edinburgh, respecting the merit to be ascribed to the several founders of the mechanical theory of heat. The first incentive to this discussion was given in a lecture "On Force," delivered by Dr. Tyndall before the audience of the Royal Institution, on June 6th, 1862, an abstract of which is found in the work whose title is placed at the head of this article. In this lecture Dr. Tyndall briefly, but clearly, places before his audience some of the grander conclusions to which the mechanical theory of heat gives rise. He first explains how mechanical energy is measured—how heat is thereby always generated; he defines the mechanical equivalent of heat, and shows the evolution of heat by the impact of bodies. He tells his hearers that whenever work is done by heat, heat disappears; and, in confirmation of this, he quotes an observation of Rumford, that a gun when firing ball becomes less heated than when blank cartridge only is fired. He then dilates upon the enormous store of energy contained in our coal-fields. A pound of coal produces by its combustion an amount of heat such as would raise, if all were applied to do mechanical work, the weight of one hundred pounds to a height of twenty miles above the earth's surface; the quantity of coal annually raised in Great Britain amounts, according to Professor Smyth, to eighty-four millions of tons: the mechanical labor which this amount of coal is capable of producing is perfectly fabulous. If one hundred and eight millions of horses were working day and night with unimpaired strength for one year, they would only accomplish as much work as we could effect by the conversion of the heat of combustion of the above quantity of coal into mechanical energy; or, in other words, we in England can do as much work by means of our coal as we could effect if each inhabitant of our islands had a gang of one hundred slaves ready to do his behests!

Dr. Tyndall then passes on to the consideration of cosmical phenomena as explained by the principles of the dynamical theory of heat, such as the maintenance of the sun's heat by the collision of asteroide, the retardation of the velocity of the earth's rotation by the friction caused by the tides, and the

heat which would be developed by the stoppage of the earth's orbital motion. He then proceeds to consider the important influence exerted by the solar radiations on the phenomena of life. Each drop of rain or flake of snow, each mountain streamlet or brimming river, owes its existence to the sun's heat. It is by the power of the sun's rays that the waters of the ocean are lifted in the form of vapor into the air, and it is by the condensation of this atmospheric moisture that every drop of running water on the earth's surface is formed. The balmy summer breeze and the devastating tornado are alike the products of change of atmospheric temperature caused by the solar heat; whilst the gradual crumbling of the "everlasting hills," and the consequent formation of stratified rocks, are sublime records of the might of the actions which, during geological ages, the sun has poured out upon the earth. Nor is this influence of solar radiation confined to the inorganic world; no plant can grow, and therefore no animal can exist, without the vivifying action of the sunbeam. The animal derives the store of energy necessary for the maintenance of life from the force locked up in the vegetable or animal organism upon which it feeds; the food of the animal undergoes combustion or oxidation in the body, and the heat thereby evolved is converted into mechanical energy; so that the labor of the animal is subject to the same laws which regulate the work done by a steam-engine supplied with vegetable fuel. We see that the animal draws its store of energy from the plant: where does the plant obtain the supply of energy necessary for its growth? The animal world cannot continually gain power from the vegetable unless the latter has as continual a supply. The source of power in the plant is found in the sun's rays; it is the sun's rays alone which enable the plant to grow, for the growth of a plant consists chemically of a decomposition or splitting up of the carbonic acid gas which exists in the air into its simple constituents—the carbon assimilated for building up the vegetable tissues, and the oxygen being sent back into the atmosphere for the subsequent use of animals. To effect this separation of the particles of carbon and oxygen a very large expenditure of energy is necessary, and this energy is supplied by the sun. The rapidly vibrating solar rays are absorbed by the plant, and their energy used

up in doing the work of tearing the particles of carbon and oxygen asunder. When the vegetable tissue burns, the carbon again unites with oxygen, forming carbonic acid, and the heat which was originally needed to effect the separation of the elements is liberated; so that the motion of the railway train is in reality due to the energy of the same rays which shone ages ago during the growth of the coal plants. It is true, as Professor Helmholtz remarks, not only in a poetical but in a purely mechanical sense, that we are children of the sun; and the warmth of our bodies, and every mechanical energy which we exert, trace their lineage directly to the sun. Without food we should soon oxidize our bodies. A man weighing one hundred and fifty pounds has sixty-four pounds of muscles; but these are reduced when dried to fifteen pounds. Doing an ordinary day's work for eighty days, this mass of muscle would be wholly oxidized. Special organs which do more work would be more quickly oxidized; the heart, for example, if entirely unsustained, would be oxidized in about a week. Dr. Tyndall having explained these and other conclusions drawn from thermodynamic principles, into which our space will not permit us to enter, concludes his picture with the following words:—

"To whom, then, are we indebted for the striking generalizations in this evening's discourse? All that I have laid before you is the work of a man of whom you have scarcely ever heard. All that I have brought before you has been taken from the labors of a German physician named Mayer. Without external stimulus, and pursuing his profession as town physician in Heilbronn, this man was the first to raise the conception of the interaction of natural forces to clearness in his own mind. And yet he is scarcely ever heard of in scientific lectures; and even to scientific men his merits are but partially known. Led by his own beautiful researches, and quite independent of Mayer, Mr. Joule published his first paper on 'the Mechanical Value of Heat,' in 1843: but in 1842 Mayer had actually calculated the mechanical equivalent of heat from data which a man of rare originality alone could turn to account. From the velocity of sound in air Mayer determined the mechanical equivalent of heat. In 1845 he published his memoir on 'organized motion,' and applied the mechanical theory of heat in the most fearless and precise manner to vital processes. He also embraced the other natural agents in his chain of conservation. In

1853 Mr. Waterston proposed, independently, the meteoric theory of the sun's heat, and in 1854 Professor William Thomson applied his admirable mathematical powers to the development of the theory: but six years previously the subject had been handled in a masterly manner by Mayer, and all that I have said on this subject has been derived from him."

These bold assertions concerning Mayer's claims to the first position amongst the founders of the mechanical theory of heat naturally called forth some remarks on the history of the subject from Dr. Joule. This philosopher states that, according to his views, Mayer's merit, and this no small one, consists in having announced, apparently without knowledge of what had been done before, the true theory of heat; but to give to Mayer, or any other single individual, the undivided praise of having propounded the dynamical theory of heat is manifestly unjust to the numerous contributors to that great step in physical science. Dr. Joule recalls the statements and experiments made by Locke and Davy upon this subject, and quotes a remarkable passage from a work published in 1839 by M. Séguin, called "*De l'Influence des Chemins de Fer.*" This French writer shows that the theory of heat generally adopted would lead to the absurd conclusion that a finite quantity of heat can produce an indefinite quantity of mechanical action; and he remarks, "*Il me paraît plus naturel de supposer qu'une certaine quantité de calorique disparaît dans l'acte même de la production de la force ou puissance mécanique et réciproquement;*" and further, "*La force mécanique qui apparaît pendant l'abaissement de température d'un gaz, comme de tout autre corps qui se dilate, est la mesure et la représentation de cette diminution de chaleur.*" Séguin likewise calculated the mechanical equivalent of heat from the mechanical effect produced by a loss of temperature in steam when expanding, and he thus obtained a number with which the equivalent afterwards calculated by Mayer most closely agrees. "Hence," says Dr. Joule, "it will be seen that a great advance had been made before Mayer wrote his first paper, in 1842. Mayer discourses to the same effect as Séguin, but at greater length, with greater perspicuity, and with more copiousness of illustration. He adopts the same hypothesis as the latter philosopher, that the heat evolved on compressing an elastic fluid

is exactly the equivalent of the compressing force, and they thus both arrive at the same equivalent." Dr. Joule then goes on to state that, in his opinion, there were no facts to warrant the hypothesis thus adopted, that the heat evolved by compressing air was the equivalent of the compressing force, or even anything approaching to it; that the dynamical theory of heat certainly was not established by Séguin and Mayer; that to do this required experiment: and he fearlessly asserts his own right to the position, which has been generally accorded to him by his fellow-physicists, as having been the first to give a decisive proof of the correctness of this theory. In answer to this letter, Dr. Tyndall replies that, in his previous course of morning lectures on heat (which were, however, delivered, according to his own showing, at a time when he was unacquainted with the extent of Mayer's labors), he had done full justice to Joule's investigations, and that, still adhering to the views he there expressed, he gives Joule the honor of being the experimental demonstrator of the equivalence of work and heat. At the same time, he says that he believes that the method of calculation adopted by Mayer for the determination of the mechanical equivalent is correct, and does not need any experimental verification; but he makes no remark whatever respecting Séguin's discovery. He likewise states that his object in the lecture in question was not to give a history of the dynamical theory, "but simply to place a man of genius, to whom the fates had been singularly unkind, in a position in some measure worthy of him." From the above extracts it is, however, clear that the merit of having first employed this method, whether it be right or wrong, is to be given to Séguin, and not to Mayer. This important point does not seem to be admitted by Dr. Tyndall, as in a subsequent letter to Professor Thomson he gives an extract from an interesting lecture on the mechanical equivalent of heat, delivered by M. Verdet, of Paris, in which the labors of Séguin are but slightly acknowledged; and Dr. Tyndall then adds, "I should deem it probable that M. Verdet knows as much about the labors of Séguin as you (Thomson) do. He certainly knows more about those of Mayer. But he does not see in the former the annihilation of the latter."

These remarks are certainly beside the

question raised by Professors Thomson and Tait, who simply stated the fact "that even on this point (that of the calculation of the mechanical equivalent) Mayer had been anticipated by Séguin, who, three years before the appearance of Mayer's paper, had obtained and published the same numerical result from the same hypothesis." Dr. Tyndall does, however, in a subsequent communication, come directly to this point by stating that he did not know, nor is he yet aware, that Séguin, had anticipated Mayer's discovery.

Professors Thomson and Tait go still further, and, whilst admitting that "Mayer's later papers are extremely remarkable and excessively interesting and certainly deserve high credit, and though they are greatly superior to the earliest cosmical speculations of Joule, are certainly subsequent to them in point of publication," give it as their opinion that "Mayer's first paper has no claims to novelty or correctness at all, saving this, that by a lucky chance he got an approximation to a true result from an utterly false analogy."

In order to enable us to judge how far this sweeping assertion is correct, we must investigate somewhat more closely than we have yet done the effects produced by the compression or percussion of bodies. If we examine a rifle bullet immediately after it has hit the target, we not only observe that it is hot, but likewise that it is flattened; in this case, supposing that none of the heat produced by the blow were communicated to the target, we should find that the bullet would not be heated as much as it should be if all the mechanical energy were changed into heat. A portion of the energy has been used up in flattening the bullet, in altering the molecular arrangement of the lead, and this is therefore lost as heat; so that if, from an experiment of this kind, we were to calculate the mechanical equivalent of the heat, we should necessarily obtain a wrong result. The heat which thus disappears is said to be used in doing *internal* work, whilst that which is set free serves to effect *external* work; and whenever we wish to get the real mechanical equivalent for the total heat produced, we must be sure that none of it is swallowed up in thus changing the molecular condition of the body; for, as M. Verdet says, in the lecture above referred to, "C'est donc commettre la plus grave des erreurs que d'établir,

comme on l'a fait quelquefois, la relation d'équivalence entre la quantité de chaleur absorbée par un corps et le travail extérieur." Now, in almost every case of the compression of bodies, the amount of internal work which is effected is very considerable; and "Mayer's statements imply the indiscriminate application of the equivalence of heat and external work to all bodies, whether gaseous, liquid, or solid, and show no reason for choosing air for the application of the proposed principle to calculation but that, at the time he wrote, air was the only body for which the requisite numerical data were known with any approximation to accuracy." The foregoing remark of Professors Thomson and Tait may be undoubtedly true, and the method adopted by Séguin and Mayer may, therefore, not be scientifically accurate; but still we must admit that Mayer's first paper certainly constitutes a very remarkable addition to our previous knowledge of the equivalence of the physical forces. Thus, for instance, he distinctly enunciates the mode of experimentation adopted by Joule, by which the mechanical equivalent can be exactly determined. "We must find out," says Mayer, in his paper published in 1842, "how high a certain weight must be raised above the earth's surface, in order that the force developed by its fall shall be equivalent to the heating of an equal weight of water from no degree to one degree centigrade." If, therefore, Dr. Tyndall has not fairly estimated the true claims of Joule, Séguin, and Mayer, as regards the establishment of the mechanical equivalent of heat, we cannot help feeling that Professors Thomson and Tait have not done justice to Mayer, as regards his wonderfully clear insight into the dependence of cosmical phenomena upon the mechanical theory of heat.

The paper published by these gentlemen, with "a view of correcting the erroneous information on this subject stealing in through the medium of the popular journals," appeared in a periodical termed *Good Words*; and in this paper the authors, having laid down the principles of the theory, proceed to ask, Whence comes the supply of energy which drives our water-wheels and forms our coal? What produces the power which is locked up in a beefsteak or in a loaf? These grand questions, as Dr. Tyndall remarks, were all answered by Mayer (and, we may

add, by Stephenson, Herschel, and others) seventeen years before the appearance of this paper, and yet the authors scarcely mention his name. M. Verdet, on the other hand, acknowledges a portion of Mayer's labors in the following words: "Ces idées, introduites pour la première fois par Jules Robert Mayer, font faire à la physiologie générale un progrès assurément égal au progrès qui est résulté, vers la fin du siècle dernier, des découvertes de Lavoisier et de Senebier sur la respiration."

It is, however, well to remember that long before Mayer published his papers on the subject, the dependence of terrestrial energy upon the sun's rays was clearly stated by Sir John Herschel in 1833. The words of this model of a thoroughly educated man of science are so striking that we cannot forbear quoting the passage in the "Outlines of Astronomy" referring to this subject:—

"The sun's rays are the ultimate source of almost every motion which takes place on the surface of the earth. By their heat are produced all winds, and those disturbances in the electric equilibrium of the atmosphere which give rise to the phenomena of terrestrial magnetism. By their vivifying action vegetables are elaborated from inorganic matter, and become in their turn the support of animals and of man, and the sources of those great deposits of dynamical efficiency which are laid up for human use in our coal strata. By them the waters of the sea are made to circulate in vapor through the air, and irrigate the land, producing springs and rivers. By them are produced all disturbances of the chemical equilibrium of the elements of nature which, by a series of compositions and decompositions, give rise to new products, and originate a transfer of materials. Even the slow degradation of the solid constituents of the surface, in which its chief geological changes consist, and their diffusion among the waters of the ocean, are entirely due to the abrasion of the wind, rain, and tides, which latter, however, are only in part the effect of solar influence and the alternate action of the seasons."

In thus considering the main points of this discussion, it appears that when Dr. Tyndall delivered his lecture "On Force," in June, 1862, he was unacquainted with Séguin's calculation of the mechanical equivalent, and that he then brought Mayer's claims more exclusively forward than he was justified in doing: it seems also probable that when Professors Thomson and Tait wrote their article

in *Good Words*, they had not seen Mayer's later papers (which being published separately as pamphlets had only become known to Dr. Tyndall a few months previously), and, therefore, did not then give him the credit to which, as they afterwards confess, his labors entitle him.

It is a difficult and somewhat delicate, though a necessary, task to endeavor justly to mark out to each laborer in the field of science the exact position which he can fairly claim; and in impartially summing up the evidence in the case before us, and remembering that "la science n'a pas de patrie," we find that we must agree with a recent French writer who terms the paper by Dr. Joule, published in the "Philosophical Transactions for 1850," "the manifesto of the new philosophy of thermo-dynamics;" but we must not, at the same time, forget that the labors of Mayer, Helmholtz, Clausius, Rankine, Hirn, and others, and especially the accurate investigations of William Thomson, have greatly helped to extend and complete our knowledge of the subject.

It is not only the changes of heat into mechanical action, which the theory of thermo-dynamics explains; this theory also furnishes a solution to many of the most complex phenomena in nature. Thus the questions of latent heat, and the heat of chemical combination, are rendered intelligible. If we warm a pound of ice having a temperature of 32 degs. Fahrenheit, we find that when all the ice is melted the water exhibits no augmentation of temperature, the thermometer still standing at 32 degs., although heat enough has been added to have heated one pound of water at 32 degs. to 143 degs. Fahrenheit. If, again, we continue to heat the melted ice, the temperature rises until the thermometer stands at 212 degs., when the water begins to boil. The thermometer now remains stationary, and the water gives off steam of the same temperature until it is all boiled away; and to convert this pound of water at 212 degs. into a pound of steam at the same temperature, nine hundred and sixty-seven times as much heat is required as is needed to raise one pound of water one degree Fahrenheit. Hence the *latent* heat of water is said to be 143 degs., that of steam 967 degs. Fahrenheit; so named by those who first observed these phenomena, because the heat thus employed to melt the ice or

evaporate the water was hidden, and not sensible to the thermometer. The mechanical theory of heat, however, explains what has become of this hidden heat. It declares that the heat thus expanded is consumed in doing internal work; it separates the particles of the ice to form water, or of the water to form steam, and it is again given off whenever the water is frozen or the steam condensed. The quantity of heat which is evolved in these changes of state is but very small compared to that set free when the constituent chemical elements of the water undergo combination. Chemists have shown that one pound of hydrogen combines with eight pounds of oxygen to form nine pounds of water, and that in this act of combination heat enough is evolved to raise the temperature of 61,200 pounds of water one degree Fahrenheit. Now, as 772 foot-pounds is the mechanical equivalent for the heat which will raise one pound of water one degree Fahrenheit, we see that the chemical union of oxygen and hydrogen to form nine pounds of water evolves heat enough to raise a weight of more than 47,000,000 pounds one foot high. In passing from the state of steam to that of water, the heat evolved by this same weight of water represents a mechanical force of 6,718,716 foot-pounds, whilst in passing from the liquid to the solid state a mechanical effect is produced equal to 993,564 foot-pounds.

"Thus," says Dr. Tyndall, "our nine pounds of water, in its origin and progress, falls down three great precipices: the first fall is equivalent to the descent of a ton urged by gravity down a precipice 22,230 feet high: the second fall is equal to that of a ton down a precipice 2,900 feet high; and the third is equal to the descent of a ton down a precipice 433 feet high . . . I think I did not overrate matters when I said that the force of gravity, as exerted near the earth, was almost a vanishing quantity, in comparison with these molecular forces: and bear in mind the distances which separate the atoms before combination—distances so small as to be utterly immeasurable: still it is in passing over these distances that the atoms acquire a velocity sufficient to cause them to clash with the tremendous energy indicated in the above numbers."

Passing over Dr. Tyndall's descriptions of his own interesting researches upon radiant heat, together with much important matter concerning the results of investigations of

other experimentalists on kindred subjects, forming a store of interest for the perusal of which we must refer the reader to the book itself, we proceed to notice a few of the wider cosmical relations interpreted by the mechanical theory of heat, and treated of by Dr. Tyndall in his last lecture. We have already remarked that the heat of gravitation of the earth (that produced by the earth falling into the sun) would supply the sun with heat for nearly a century; we now learn from the researches of Professor William Thomson that the heat of gravitation of all the planets is equal to that radiated by the sun in 45,589 years, whilst the heat which would be developed by stopping the rotation of all the planets on their axes is equal to that emitted by the sun in one hundred and thirty-four years. Helmholtz, in a valuable memoir on the conservation of force, has shown, that, if the solar system has ever been a nebulous mass of extreme tenuity, the mechanical force equivalent to the mutual gravitation of the particles of such a mass would be four hundred and fifty-four times the quantity of mechanical force which we now possess in our system; 453-454ths of the gravitating tendency has been already satisfied and wasted as heat. The 1-454th that remains to us would, however, if converted into heat, raise the temperature of a mass of water equal to the sun and planets in weight 28,000,000 degs. centigrade. The heat of the lime light, Dr. Tyndall remarks, is estimated at 2,000 degs. C.: of a temperature of 28,000,000 degs. C. we can, therefore, form no conception. If our entire system were pure coal, by the combustion of the whole of it only 1-3500ths of the above enormous amount of heat would be generated.

"But," to quote the eloquent words of Helmholtz, "though the store of our planetary system is so immense as not to be sensibly diminished by the incessant emission which has gone on during the period of man's history, and though the time which must elapse before a sensible change in the condition of our planetary system can occur is totally incapable of measurement, the inexorable laws of mechanics show that this store, which can only suffer loss and not gain, must finally be exhausted. Shall we terrify ourselves by this thought? Men are apt to measure the greatness of the universe, and the wisdom displayed in it, by the duration and profit which it promises to their

own race; but the past history of the earth shows the insignificance of the interval during which man has had his dwelling here. What the museums of Europe show us of the remains of Egypt and Assyria we gaze upon with silent wonder, and despair of being able to carry back our thoughts to a period so remote. Still the human race must have existed and multiplied for ages before the pyramids could have been erected. We estimate the duration of human history at six thousand years; but, vast as this time may appear to us, what is it in comparison with the periods during which the earth bore successive series of rank plants and mighty animals, but no men?—periods, during which, in our own neighborhood (Königsberg), the amber tree bloomed, and dropped its costly gum on the earth and in the sea; when in Europe and North America groves of tropical palms flourished, in which gigantic lizards, and after them elephants, whose mighty remains are still buried in the earth, found a home? Different geologists, proceeding from different premises, have sought to estimate the length of the above period, and they set it down from one to nine millions of years. The time during which the earth has generated organic beings is again small, compared with the ages during which the world was a mass of molten rocks. The experiments of Bischof upon Basalt show, that for our globe to cool down from 2,000 degs. to 200 degs. C. would require three hundred and fifty millions of years. And with regard to the period during which the first nebulous masses condensed, so as to form our planetary system, conjecture must entirely cease. The history of man, therefore, is but a minute ripple in the infinite ocean of time. For a much longer period than that during which he has already occupied this world the existence of a state of inorganic nature favorable to man's continuance seems to be secured, so that for ourselves, and for long generations after us, we have nothing to fear. But the same forces of air and water, and of the volcanic interior, which produced former geologic convulsions, and buried one series of living forms after another, still act upon the earth's crust. They, rather than those distant cosmical changes of which we have spoken, will end the human race, and perhaps compel us to make way for new and more complete forms of life, as the lizard and the mammoth have given way to us and our contemporaries."—P. 428.

In speaking of the universal character of the sun's actions upon the earth, Dr. Tyndall tells us that, leaving out of account the eruption of volcanoes and the ebb and flow

of the tides, every mechanical action on the earth's surface, every manifestation of power, organic and inorganic, vital and physical, is produced by the sun's rays. He then proceeds:—

"His (the sun's) warmth keeps the sea liquid and the atmosphere a gas, and all the storms which agitate both are blown by the mechanical force of the sun. He lifts the rivers and the glaciers up the mountains; and thus the cataract and the avalanche shoot with an energy derived immediately from him. Thunder and lightning are, also, his transmuted strength. . . . He rears, as I have said, the whole vegetable world, and through it the animal; the lilies of the field are his workmanship, the verdure of the meadows, and the cattle upon a thousand hills. He forms the muscle; he urges the blood; he builds the brain. His fleetness is in the lion's foot; he springs in the panther; he soars in the eagle; he glides in the snake. . . . His energy is poured freely into space, but our world is a halting space where this energy is conditioned. Here the Proteus works his spells; the self-same essence takes a million shapes and hues, and finally dissolves into its primitive and almost formless form. The sun comes to us as heat; he quits us as heat; and between his entrance and departure the multiform powers of our globe appear. They are all special forms of solar power—the moulds into which his strength is temporarily poured, in passing from its source through infinitude. Presented rightly to the mind, the discoveries and generalizations of modern science constitute a poem more sublime than has ever yet been addressed to the intellect and imagination of man. The natural philosopher of to-day may dwell amid conceptions which beggar those of Milton."—P. 432.

Grand as are the truths which this peroration is intended to set forth, we cannot read them without regret that these somewhat inflated expressions should have been put forward as a complete statement of the facts of the case. If that were Dr. Tyndall's intention, we should object to the very partial view of nature which he would appear to set before his audience. On hearing words such as those we have quoted, the half-educated scientific enthusiast would be inclined, and so far as these words go entitled, to believe that this influence of the sun's rays explains all terrestrial actions—all life, all nature; that henceforward a complete knowledge of nature would be gained from this transcendent element; that, as the solar ray "forms the

muscle and builds the brain," the secrets of life are exhausted, and mental as well as physical action is easily referable to a material standard. Yet how far is this from really being the true state of things! and how completely would such a thinker be misled! Dr. Tyndall knows this as well as any man, and yet, for the sake of making his point clear, and in order to avoid distracting the attention of his audience from his subject, he, no doubt purposely, omitted to refer to those unknown and unexplored, depths met with on every side in the great mine of nature—depths which the glimmering lamp of our present imperfect knowledge only serves to render more apparent. One of the difficulties with which popular scientific lecturers have to contend is that of presenting a subject in such a form as to come home to the audience in its true relations not liable to be misunderstood, and of painting one side of the picture forcibly with-

out losing the harmony of the whole. It would, in our opinion, have been well if Dr. Tyndall had in conclusion reminded his audience that, much as Science can do, it never can explain everything; that, although the body is built up and sustained by solar power, there are mysteries connected with life towards the explanation of which Science offers no clue whatsoever. If he had only hinted at our complete ignorance of the nature of the silent power which bids the oak spring from the acorn, or builds up from the simplest cell the widely differing forms of animal life, he would have done much to present to his hearers' minds the truer view of Nature's infinitude and man's littleness expressed by Newton in his noble words: "To myself I seem to have been as a child playing on the sea-shore, whilst the great ocean of truth lay unexplored before me."

THE great event of the week to England is the loss of her great satirist, Mr. Thackeray, who died early on the 24th of December, in the fifty-second year of his age, of effusion on the brain, brought on, it is supposed, by violent sickness, to which he was periodically subject. Of a new novel promised by him to the *Cornhill Magazine* he had completed four numbers, and only two or three days before his death was showing his achievement to a friend in the most buoyant spirits. His death at the season which has so often been associated with his lighter literary efforts strikes us with something of the same imaginative effect as those Christmas books themselves, in which the thin veil of superficial gayety was constantly blowing aside, and showing the graduated depths of darkness beneath. He is the founder of a school of satire of which he will probably be the only master, though he has already had many imitators. We do not wonder that he failed as a painter, for painting, which must select an effect visible in a single moment of time, gave no scope to the peculiar mobility of his genius. He delighted in varying indefinitely the expression visible on the face of his characters, so that before the contraction of the suffering nerve, or the sneer of the parted lips was distinctly visible, it was gone, and if you sought to recover the source of the impression it was seldom easy to do so. There was a strange mixture of pain and pathos in all his pictures; bitterness and tenderness mingled their tones in the laugh of the humorist, and there was something at once loving and fatalistic about the frequent gleams of his religious feeling. Tennyson has expressed the essence of his genius, though not its highest temper, in the line:—

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"Out of that mood was born  
Self-scorn—and then laughter at that self-scorn."

—*Spectator*, 26 Dec.

*Scriptural Paraphrases: being a Commentary wholly Biblical on some of the Collects, Epistles, and Gospels.* By a Layman. Edinburgh: The Caledonian Press; London: Longman & Co. Pp. 661.

THIS bulky volume must have been a labor of love. It consist throughout of question and answer; and on the margin of every page will be found those textual references on which the scriptural authority of the answer is based. The author's system of "comparing spiritual things with spiritual, or one sentence in the Bible with another, to impart a general knowledge of the Holy Scriptures," cannot be too much commended. So comprehensive, however, is the author's scheme, that the volume may very properly be regarded as meant to include a whole body of sound divinity. In order that the subject-matter of so large a book may be properly within the reach of the reader in the way of reference, the author has prefixed an elaborate "analysis" of the book, alphabetically arranged.—*Reader*.

THE first volume of a translation of Mr. Ticknor's "History of Spanish Literature" has just appeared under the title of "Histoire de la Littérature Espagnole de Gen. Ticknor; Ire Période. Traduite, avec les Notes et Additions, etc., par J. G. Magnabal."

From The Westminster Review.  
THE TUNNEL UNDER MONT CENIS.

1. *Senato del Regno. Rapport du Bureau Central, composé de Messieurs les Sénateurs de Brignole-Sala, Plana, Mosca, De la Marmora, et Jacquemoud, sur le Projet de Loi pour la percée du Mont Cénis, et l'Approbation du nouveau Cahier de Charges de la Compagnie Victor Emmanuel.* Turin: 1859.
2. *Discorso del Ministro dei Lavori Pubblici, Conte Menabrea, pronunziato alla Camera dei Deputati nella tornata del 4 Marzo, 1863, sul Traforo del Montcenisio.* Torino: 1863.
3. *Traforo delle Alpi tra Bardonnèche e Modane: Relazione della Direzione Tecnica alla Direzione Generale delle Strade Ferrate dello Stato.* Torino: 1863.

FANCIFUL speculators have often amused themselves with the question, What would remain of London were it abandoned for two or three thousand years, like the cities of Assyria? Lord Macaulay figured to himself a New Zealander musing over a vast heap of bricks at some period in the far future, but perhaps by the time A.D. 4000 or 5000 had arrived, even bricks might have disappeared, and nothing be left but a gigantic mound of dust, which the one near Easton Square, lately sold for a vast sum, may represent to our fancy, in spite of its diminutive scale. This image is certainly not calculated to give us a grand idea of the nineteenth century, especially if we compare it with the splendid ruins which still attest the power of Nineveh and Rome. But a little reflection may perhaps help us to save over the wound to our vanity. The remains of bygone days are the memorials of individuals; the palaces of old recall the name of some dead tyrant, and even the most useful works of antiquity—the Roman aqueducts—were but the presents of emperors to their subjects; whereas now the object for which we labor has been displaced, and the advantage of millions, instead of the gratification of unites, is the aim we strive after. If our cities are no longer adorned with buildings of a material and massiveness calculated to resist the assault of ages, it is not that our engineers are incapable of producing works worthy to excite the admiration of posterity. We no longer, indeed, build pyramids to shroud the bones of some dead Rameses, or erect a cathedral like that of Glasgow to the memory of an obscure St. Mungo; but in this very island we have

spanned arms of the sea with railway bridges under which the largest line-of-battle ship can pass, all sails set; our nearest neighbors are toiling, despite a short-sighted and ungenerous opposition, to open a canal between the Mediterranean and Red Sea, while another scion of the Latin race is working equally hard to pierce the natural barrier of the Alps, and put their railway system in direct communication with that of the rest of Europe. To the present generation the Menai tubular bridge is a nine days' wonder; the Suez Canal has been discussed until the subject has been worn threadbare, and must now be left to the practical test of success; but the third great engineering work of the day is almost unknown in England, at least in its details, and we therefore propose to devote some pages to an account of this marvellous tunnel—marvellous, not so much from its great length, though that will be between seven and eight miles (12,220 mètres), as from the scientific interest attached to the employment of natural forces not hitherto utilized.

At the late meeting of the British Association at Newcastle, Sir William Armstrong startled, and probably alarmed, many of his hearers by imparting his opinion that the seams of coal in these islands would be exhausted in little more than two centuries. Posterity will have to judge of the accuracy of this calculation. It may perhaps be found that as coal becomes dearer by the working out of the upper veins, it will be profitable to sink the shafts down to the lower ones, now left untouched because the market price is not such as to cover the expense to be incurred, and a supply be thus obtained for a considerably longer period. Be this as it may, however, there can be no doubt that we are now expending coal at a rate far more rapid than that at which it was formed by the decay of primeval vegetation; and it would therefore be a discovery of no small benefit to our race were it possible to find some power capable of setting all our manufacturing machinery in action, other than steam, to generate which in sufficient quantities so vast an amount of coal is daily consumed; and the advantage would be all the greater if the new force we desiderate could be one sure not to be exhausted so long as the physical conditions of our globe remain unchanged, or indeed fit for the habitation of such creatures

as ourselves. The only two forces of which this can be predicated with any safety are *air* and *water*, and the use that may be made of them is the great lesson to be learned from a consideration of the tunnel under Mont Cénis.

Scarcely had the importance about to be assumed by the railway system of Europe been acknowledged, than a tunnel under the Alps became the dream of engineers, especially those of Italy. It is indeed evident, that even supposing the Peninsula suddenly endowed with a railway net as complete as that which intersects the manufacturing districts of the West Riding or Lancashire, Italy must be cut off from the great flow of transit and traffic so long as no direct communication exists between her railway system and that of other nations. The difficulty of creating one was, however, enormous, and the Alps presented an obstacle as difficult to turn as to overcome. Apart from all engineering impediments, the Corniche line implied so great a circuit, that the railroad journey from Paris to the Valley of the Po by this route would have cost more in time and money than the twelve or fourteen hours' passage over Mont Cénis in a carriage; and the same might be said of the circuit round the upper end of the Adriatic, without adding that the problem would not have been in any degree solved even thus, before the construction of the remarkable ascending lines over the Bocchetta Pass and the Simmering. Nor when these were made, did the questions seem nearer to a real solution. The Alps were too high to be crossed by this system, even had the snow which covers them for half the year not opposed an invincible obstacle, and the same double objection presented itself to the construction of a tunnel on any method hitherto employed, for shafts could not be thought of, and yet no tunnel of even a quarter the length had hitherto been considered possible without them. Nevertheless, as a tunnel seemed the only resource, engineers continued to devise schemes for piercing it, more or less impracticable, very much like those we periodically hear of for bridging over or boring under the Channel.

To add to the difficulty, it so happened that Mont Cénis, the shortest and most frequented of the Alpine passes, the one by which it was soonest possible to reach the

plain and the railway system on either side, and which the genius of Napoleon had marked out as the true line of communication between France and Italy, was in the hands of a third-rate State, counting scarcely five millions of inhabitants. Fortunately, however, though the kingdom was small, its destinies were directed by the greatest statesman of our day—one whose eagle glance took in far more than the interests of the moment, and who, foreseeing the time when Piedmont would be Italy, was steadily bent on preparing her to play the part of a great power. As it happened, also, the minister was not only a skilful politician, but he had received an admirable scientific education, and when three engineers, whose names deserve to be chronicled for all ages, MM. Grandis, Grattoni, and Sommeiller, supported by the authority of M. Ranco; whose views gained weight from the distinguished part he had taken in the construction of the Genoa and Turin Railway, presented their invention to him, Count de Cavour did not turn away with disdain, because no tunnel had ever before been pierced by machines impelled by compressed air\* produced by the action of water, but rather saw in the novelty of the idea a ground for hoping that difficulties insuperable by any means usually practised would thus be overcome. To the above-mentioned four engineers, in the first instance, and secondly, but no less perhaps, to Count de Cavour and his two illustrious friends and colleagues, M. Paleocapa and General de Menabrea, who concurred and sympathized in his opinion of the feasibility of the scheme, will the world owe lasting gratitude for breaking down the barrier of the Alps, and still more for introducing a new motive power into mechanics.

The whole scheme was so new, that the first thing to be done was to test the models of the proposed machines. A Commission of five persons was therefore appointed by the Piedmontese Government to try a series of experiments, to prove the possibility of compressing air by water-power, and then conveying it to a distant spot there to put a perforating-machine in motion, and also to determine

\* An Englishman, Mr. Bartlett, had previously adopted a perforating-machine for boring holes for mines, eight or ten times quicker than by hand; but this machine was impelled by steam, a method evidently inapplicable, from the want of air in a tunnel of great depth and without shafts.

whether so long a tunnel without shafts could be ventilated.

The report of this Commission was so favorable as fully to answer to the far-sighted anticipations of the minister. Much doubtless remained to be done, for the machines tested were mere models, requiring to be greatly modified and increased in size before they could be used on a large scale: still the principle was so well established, and the whole scheme appeared so far superior to any other that either had been, or was likely to be presented, that the commissioners did not hesitate to recommend its immediate adoption. At the same time a favorable conjuncture presented itself by the absorption of the companies running the lines between Susa and the Ticino into the Victor Emmanuel Railway, and when the bill for this fusion was brought in, the Government added clauses authorizing the construction of the tunnel by the State, and the necessary expenses, to which the Company agreed to contribute a sum of 20,000,000 francs (£800,000) besides premiums on the shares, and so great was the faith inspired by Counts de Cavour and Menabrea, that the Piedmontese Chamber of Deputies actually passed this audacious law by a large majority.

The practical difficulties of the enterprise now began. But it was much that the project should have been approved, and the confidence of the Government and the Parliament would have been a spur to the energy of the engineers had not the grandeur and glory of the undertaking itself been sufficient to excite their utmost zeal. No sooner had the bill passed into law than the works were begun, in the autumn of 1857. The trigonometrical survey necessary to obtain an accurate tracing of the axis of the future tunnel was in itself no slight task, if we consider that its extreme points could not be made visible from one another without placing them at a distance which would have rendered any accurate observation impossible, and also that all the operations had to be carried on at heights varying from three thousand to ten thousand feet above the level of the sea and amidst the constant atmospherical changes characteristic of such elevated regions. The first difficulty was overcome by establishing an observatory on the very summit of Grand-Vallon, the highest peak in that part of the Alps, and two extreme points of the axis in the same

vertical plane with it and one another, having been determined by turning the theodolite 180 degs., it was comparatively easy to fix the intermediate signal points on each side one by one, always keeping the extreme point in view, and then lowering the instrument perpendicularly until a site for an observatory had been found in each of the two opposite valleys of Rochemolles and Fourneaux, exactly on a level with and opposite to the respective entrances to the tunnel, so that the signals received from the outside could be repeated underground, and the works kept on the correct line necessary to ensure the junction of the two halves under the very centre of the mountain. To increase the difficulties to be contended with, it was found that the valley of Rochemolles was more than seven hundred feet higher than that of Fourneaux, on which account it was determined to give a slope of twenty-two in one thousand to half the tunnel.

Nor were the obstacles presented by the ground confined to the trigonometrical survey. Every single article required for the works, or for the persons engaged in them, from the chief engineers to the lowest laborers, had to be conveyed from the plains below. Fourneaux, indeed, though itself a wretched hamlet, was not very distant from Modane, a considerable village situate on the main road into France; but Bardonnèche, the opposite end, is not only distant from Susa, the nearest railway terminus, but nearly 2,500 feet above it. Yet it was requisite here to assemble vast bands of workmen, with their foremen and directors; to provide dwellings and daily food for so vast an increase of population in a place the resources of which barely sufficed for the wants of its own inhabitants; to construct canals, huge reservoirs, workshops, and engine-houses; and finally to set up an immense system of machinery with which no one could boast himself practically acquainted, and every portion of which had to be separately brought from Seraing in Belgium where it was originally constructed.

All this required time; and that not a moment might be unnecessarily wasted, it was resolved to begin boring the tunnel at both ends by the ordinary methods. The progress made might not be great; still, every yard gained was always something, and it was the only resource until the machines were con-

structed and fairly set in motion. So the works began in 1857 itself, and were continued at Bardonnèche (at Fourneaux even longer) until January, 1861, for owing to various reasons, chief among which may be mentioned the war of 1859, which stopped all the transports for nearly a year, it was not till then that the mechanical perforation could be inaugurated. Nor will this lapse of time seem excessive if we reflect how much had to be done before attaining this first result. Not only had the machinery to be designed and constructed, with the improvements suggested by the experiments made by the Commission, to arrive from Belgium, and be put together in the engine-house, but two large reservoirs, one twenty-six, the other fifty mètres above it, had to be prepared, and a supply of water sufficient to keep the former constantly full brought through a canal from a torrent more than a mile distant, and all these works in solid masonry had to be roofed in, to preserve the water from the influence of the frost. And when all this was done, the machinery had to be tried repeatedly and for a considerable time before it could be employed with safety to the mechanics entrusted with it, or with advantage to the works in the tunnel itself.

After repeated trials, the machinery was at length brought into working order, the pipes for conveying water and compressed air from the machine-house where it is produced, to the further end of the tunnel where the works were proceeding, were laid down in a trench which, in the finished section, is built in to serve as a main drain, as well as a third pipe for gas, which is fabricated in a gasometer just outside the entrance, and the additional light of which is found greatly to facilitate the manœuvres of the workmen, while, not being affected by the explosions, etc., constantly going on, the whole apparatus gives less trouble than a single lamp. At last, the perforating-machines were pushed in on a framework along rails prepared for the purpose, and since that time they have continued to be employed. At first there were many interruptions, owing to various causes, and especially the awkwardness of the workmen in dealing with machinery of which they had not the slightest experience, and many days were of course lost; still the report before us testifies to the general satisfaction of the engineers, and also to the fact that every suc-

ceeding month of increased practice sees the work proceed with greater facility and regularity.

Nothing can be more curious than the account M. Sommeiller gives of the manner in which the works proceed. The section of the tunnel which the machines are employed to excavate is about eleven feet wide and eight high; a double rail runs along the centre, upon which a framework upon wheels is rolled forward, carrying the ten perforators, of which nine are usually kept at work at once, close up to the face of the rock. Once there, the distributing pipes for air and water which are fixed on the frame are put in connection with the main tubes, carried along under the floor of the tunnel from the machine-house outside by means of flexible pipes, and each perforator is then supplied with air and water by turning the cocks belonging to it in the distributing pipes. Pressed forward by the compressed air, the augers then strike the rock, which they pierce very much as a gimlet bores a plank, only that by a special contrivance they recede after each blow, that a jet of water may be impelled into the hole being bored, in order to clear it of dust, and to keep the auger itself cool. This retrograde motion is produced in a manner very similar to that in which the same movement is given to the piston of a steam-engine. In the perforating-machine the auger is fixed to the end of a piston moving backwards and forwards in a cylinder. Compressed air enters this cylinder at both ends; but as it is contrived that the front surface of the piston (the one towards the rock) upon which it presses should have only half the size of the other end, it follows that at an equal pressure of six atmospheres, the pressure received from behind is twice as potent as that in the contrary direction, and the auger strikes the rock, although less violently than if there were no compressed air in front of the piston to resist its forward motion. As soon as the blow has been given, however, this relative proportion of the strength of pressure is reversed. The valve by which the compressed air enters the portion of the cylinder behind the piston closes; and another, communicating with the outer atmosphere, opens. This escape being afforded, the forward pressure is immediately reduced to the strength of one atmosphere, which is of course overcome, and the piston recedes, while the compressed air

which has just escaped resumes its primitive volume, and thus fulfils its second purpose, by driving out the mephitic air, which naturally collects in so small a space with no draught through it, and supplies the workmen with fresh air to breathe. The augers of the perforating-machines continue their work until eighty holes have been bored, each from twenty-seven to thirty-two inches in depth, an operation often accomplished within six hours, though in the beginning especially, it took a good deal more—ten, or occasionally even fourteen hours. The connection with the main pipes is then cut off, and the whole framework, with all its apparatus, is rolled away by the workmen to a distance of a hundred and fifty to two hundred yards, behind great gates made of thick planks and beams, called “safety-doors.” A fresh gang of workmen, the miners, then appear on the scene, whose duty it is to load the mines thus prepared, and then to fire them. No sooner have the mines been exploded, those in the centre, where they are closer together, first, then the ones on the circumference, than a burst of compressed air is admitted into the farthest end of the tunnel, to clear it from smoke and the gases produced by the explosion, and a third set of workmen arrive, with a number of little trucks running upon side rails laid for this special service, in which they cart away the fragments of rock brought down by the explosion. In this way about a yard of progress is generally attained.

At first this operation could only be attempted once in the twenty-four hours, owing to the inexperience of the workmen, of whom only a small number could be taught to use the machines at once; but gradually it was found possible to organize a second gang, and after that, whenever a series of manoeuvres such as those above described was effected within twelve hours, it was immediately repeated; and as improvements are gradually introduced into the machinery, and the workmen acquire greater facility in employing it, M. Sommeiller and his colleagues express their hope that it will be possible for them either to make three breaches in the rock every twenty-four hours, or else to attain a more rapid rate of progress by boring deeper holes each time, if two attacks only be found more advantageous.

After the small section of the tunnel has

been excavated by the perforating-machines, it is enlarged by the ordinary method—a work which it is always the endeavor of the directing engineers to keep at a certain proportionate distance from the front of attack; while the masons who build in the part of the tunnel already enlarged to its full size, follow close upon the workmen who have been digging it out with their picks, for it is of course desirable to leave as little as possible to be done towards completing the tunnel after the mountain shall once have been pierced.

But we need not dwell on this part of our subject, which offers no peculiarity worthy of remark: we will rather say something of the special machinery employed, and particularly of the two systems at work for obtaining the necessary supply of compressed air.\* The report of M. Sommeiller is accompanied by a series of drawings, with detailed descriptions, without which it would be of course impossible for any one to master all the intricacies of these machines; but we may perhaps be able to give our readers some notion of the system employed. The first idea was that of what is called a column compressor. It had been calculated that a tension of six atmospheres was required for the compressed air to be employed in the tunnel, and to produce this, a fall of twenty-six metres (eighty-five feet four inches) was found necessary to give a sufficient impetus to the descending rush of the volume of water which was to compress a certain amount of common atmospheric air to this extent. This fact once having been theoretically ascertained by calculation, the means of reducing it to practice were simple enough. At Bardonnèche there was no difficulty in procuring any quantity of water with which to fill a reservoir eighty-five feet above the machine-house, and this reservoir serves to feed ten compressing columns in the shape of syphons, each of which communicates with a chamber filled with atmospheric air, of such a height and size that the impetus of the water when turned on is just sufficient to carry it to the top. This is effected by opening a valve in the column, through which the water in the upper part (previ-

\* In 1862 the production of the ten compressors at Bardonnèche was no less than 1,404,000 cubic metres of compressed air, and it is found that a still greater quantity will be required as the works advance farther from the outer air.

ously, as it were, suspended) rushes, pushing before it the water at rest below the valve in the lower part of the syphon formed by the column. Rapidly rising above its original level at the bottom of the chamber, the invading water thus compresses the air therein contained, until it has attained a tension of six atmospheres, at which point it has acquired strength sufficient to raise a valve at the top of the chamber, and thus escape into a recipient specially prepared for it. Every particle of compressed air is driven out by the pursuit of the water, which continues to rise until it touches the top of the chamber, when, at the very moment, the valve in the column is shut, so as to cut off the downward rush; another valve\* situated in the lower part of the column is then simultaneously opened, to allow the water in the compressing chamber to run off until it has sunk to its normal level in the syphon, after which fresh atmospheric air is admitted into the vacuum above it, through a series of suspended valves at the side of the chamber, which are shut by the water as it rises, and open again by their own weight as it recedes, and the operation is thus indefinitely repeated, at the rate of three pulsations per minute. At Bardonnèche there are ten compressors constantly at work, every one of which can be stopped for repairs without interfering with the rest, and each impels the air it has compressed into its own recipient. The ten recipients of compressed air, however, communicate together, and a very simple and beautiful contrivance has been resorted to in order to keep the tension in them invariable, independently of the production going on in the compressors, and of the quantity drawn off for use through the pipe carried into the tunnel. To effect this, a vast reservoir of water was constructed, 50 mètres (163 feet 5 inches) above the recipients, connected with them by a long pipe. The static weight of the water thus superimposed on the compressed air being exactly sufficient to maintain it at a tension of six atmospheres, when the supply of air is low, the water enters the recipients, when on the contrary it is superabundant, the water is forced back up the pipe into the reservoir.

\* The alternate play of these two valves—one of which is always open and the other shut—is regulated by a contrivance called an aerometer, also set in motion by compressed air.

When this system was first proposed there were innumerable objections urged against it in the scientific world. It was declared impossible to construct recipients strong enough to hold a supply of compressed air, which was thought capable of bursting the vessel in which it was enclosed, and perhaps even of oozing out through the pores of the cast-iron plates of which it was made. The practicability of conveying compressed air to any distance through pipes, without a loss of tension rendering it utterly useless, was even more strongly and generally insisted on. Fortunately, the experience acquired at Bardonnèche affords a full refutation of these unfavorable predictions; for we learn that not only is there no escape of air from any part of the machinery or pipes, sufficient to stir the flame of a taper, but experiment shows that the loss of tension liable to be incurred in the transport of compressed air would not equal one-tenth of an atmosphere in any distance less than 25,000 mètres, or nearly four times that which it can be required to traverse for the works under Mont Cenis! Another fear also expressed by the opponents of the tunnel was, that from want of shafts the workmen employed must necessarily be suffocated; it is, however, found that though the temperature is somewhat higher, it is as easy to breathe at the further end of the tunnel as on the hillside itself, since a quantity of compressed air is daily impelled into the small section seventeen times greater than its cubic capacity, and this rush of compressed air not only renews the atmosphere, but also tends to moderate the heat generated by the presence of a large number of workmen in a small space, in which a number of gas-lights are perpetually burning; for it has been demonstrated by experience, that when air is compressed it loses a portion of its natural caloric, whence it follows, that when it resumes its primitive volume on being allowed to escape, it is ready to absorb an amount of heat equal to that which it had previously emitted. From what we have already said, our readers will readily perceive that there need be no fear of the workmen being suffocated; nevertheless, the directing engineers proposed at least to double the supply of compressed air before the end of 1863.

At the northern entrance, the system employed for compressing air is different, and of greater general interest, since it is more

readily applicable than that of the column-compressor, which requires a quantity of water and a fall by no means attainable everywhere, as was soon found to be the case at Fourneaux, where one torrent at a sufficient height above the engine-house had not the necessary supply of water, and another, which was abundant, had but an insignificant fall. To combat this difficulty, the first device was to raise water to the requisite height by means of hydraulic wheels, when a new invention, the pump-compressor, afforded a real solution of the problem, so satisfactory, that it will supply three times the amount of compressed air, while the machinery costs one-third less than the column-compressor. In this machine the compression is effected by a piston, which an hydraulic wheel causes to move backwards and forwards in a chamber communicating with two vertical columns, supplied with water in such a way and such a quantity, that when one is full the other must be empty, and this occurs alternately as the piston moves. Each time a vacuum is left in the one, it is filled with air from the outer atmosphere, which the water on its return compresses until it acquires sufficient tension to raise a valve and escape into a recipient, just as in the column-compressor. In this machine, however, the air is driven into the vacuum by water flowing from an outer basin. This water serves a double purpose; when the column is full of air, it accumulates over the valve by which the latter has entered, and the superimposed weight prevents any leakage through this valve when the air begins to be compressed by the return of the piston; when, on the other hand, the column is empty, the water flows in, entering with the air, and makes up for the loss of the water in the column caused by evaporation. Any extra amount which may thus enter escapes with the compressed air into the recipients, at the bottom of which it accumulates until it is enough in quantity to raise a concentric float under which it makes its way out, and which then closes again over the orifice. It is calculated that each pump-compressor is able to supply the works with thirty litres (nearly seven gallons) of compressed air per second, and when six of them shall be at work, according to the declared intention of the engineers, it is evident there will be no difficulty in obtaining a quantity of compressed air amply sufficient

for the perforating-machines, for renewing the atmosphere in the tunnel, and for speedily clearing it of smoke after the explosion of the mines.

At Fourneaux, two other contrivances of considerable interest are in use. We have already said that the valley of Rochemolles is at a level considerably higher than that of the Arc; so much so, that the tunnel, which at the south entrance is at the bottom of the one valley, issues out at the north end at a height of 186 mètres (347 feet 10 inches) above the opposite one, in spite of the slope given to half of it. To obviate the inconvenience of having to drag everything required for the works in the tunnel up so considerable a perpendicular height, the engineers bethought themselves of constructing an automatic plane between the platform at the mouth of the tunnel and the valley below, sufficiently wide for a double line of rails to be laid on it. At the top stands a large drum with a cable, each end of which is attached to a truck, one of which is at the top while the other is at the bottom. When the latter has been loaded, the former is filled with water, and descends by its own weight, dragging up the other as it moves; a contrivance by which a weight of fifteen hundred kilogrammes (not far from a ton) can be raised in a few minutes, and the water being emptied out of the truck which reaches the bottom, it is ready to convey another load to the top in its turn.

The second contrivance, peculiar to Fourneaux, concerns the ventilation. When the tunnel shall be completed, in order to allow the railway lines from each side to run into it, it will be necessary to make it take a curve up the valleys on each side, and a branch from the main tunnel is already being excavated for this purpose at Bardonnèche, in addition to the straight one, which will be kept open, as it facilitates the work and the admission of air. In spite of the straight line observed at Fourneaux, the slope inwards of 22 per 1000 is found to be a great obstacle to the entrance of a current of fresh air, in spite of the difference of temperature which had been counted on to promote it. A special contrivance has therefore been devised for sucking out the bad air which accumulates in the tunnel, through a large wooden conduit hanging from the roof. The torrent of Charmaix has been made to supply a small quan-

tity of water with a fall of 70 mètres (in round numbers 230 feet) which, by means of a wheel, sets two enormous pistons in motion. These alternately raise and let fall a mass of water enclosed in two chambers, communicating with the conduit from the tunnel; as the water sinks in each alternately the vacuum thus produced is filled by the bad air, which is immediately afterwards expelled into the outer atmosphere by the return of the piston; and it is calculated that in this way all the mephitic air likely to be generated will be drawn off without difficulty, even when the works shall be under the centre of the mountain.

We have now sketched the peculiar machinery employed for tunnelling Mont Cénis. The perforators we will not attempt to describe minutely, partly because the extreme complication of parts necessary to fit them for their various functions is such as to render them unintelligible without the assistance of drawings on a large scale, and also because the great singularity in them that we wish to impress on our readers is quite independent of their arrangements and form; viz., that of their being kept in motion by compressed air, conveyed from a distance which even now exceeds a mile, and will be considerably more before the works are terminated. For the first time since the application of steam to machinery, a great engineering work is being carried on without its assistance; and the accounts given of the success attained in the employment of compressed air, as well as the small cost, calculated per dynamic horsepower, ought to commend this great enterprise to general attention. Air is a commodity to be obtained everywhere; water is neither scarce nor dear, especially if we remember that it is by no means necessary to produce compressed air at or even near the spot where it is to be employed, for even supposing it has to be conveyed to a distance such as to occasion a considerable loss of tension (and experience, confirming the tables of the Commission, shows that this would not occur at any moderate one), it would suffice slightly to raise the degree of the original compression, a result which it is found can be attained by the same water power, provided the quantity of air to be operated upon be reduced in proportion to the additional tension it is desired to give it. The column-compressor, indeed, was not generally

applicable, owing to the great fall required to make the water used for compression descend with sufficient impetus, but this difficulty is removed by the invention of the pump-compressor, for which but a very small quantity of water, and no fall, is required, and in which, if necessary, another motive power, such as the wind, we conceive, or steam, might be substituted for the hydraulic wheels used to move the compressing pistons at Fourneaux. A review intended for general perusal is not the place in which to discuss the applications which may be made of the working power contained in compressed air, nor to enter on the abstract scientific advantages it presents: nevertheless we cannot refrain from expressing our hope that engineers will take advantage of the works now going on at Mont Cénis to make themselves practically acquainted with this new motive force, and to study the use that may be made of it elsewhere.

The scientific interest in the tunnelling of the Alps, excited by the employment of compressed air, though in our eyes the chief, is by no means the only one connected with this great enterprise, the importance of which, owing to the political events of the last seven years, has enormously increased since the project was first presented to Count de Cavour. When the bill authorizing the tunnel passed, both slopes of the Alps belonged to the same State, the two parts of which it was to connect, while it put the Mediterranean port of Genoa in communication with France, Switzerland, and Germany; but, owing to the restrictive commercial policy of the governments that then ruled all the rest of Italy, its influence did not seem likely to extend further south. Three years, however, sufficed to bring great changes. The southern half of the Italian peninsula had fused itself with the northern, and the frontier of France was on the crest of the Alps. Savoy having thus passed into the power of another State, a special convention was concluded on the 7th of May, 1862, to regulate the interests concerning the tunnel. The Italian Government insisted on retaining the exclusive command and direction of the works, which it had begun at its own risk and cost; but it was agreed that when they were terminated, France should pay for half the length at the rate of three thousand francs per mètre; and, moreover, that for

every year less than twenty-five—the extreme limit of time fixed by the convention—she should pay an additional sum of 500,000 francs, a premium to be raised to 600,000 per annum if the works be terminated within fifteen years.

Our readers thus see how great an interest the Italian Government has even financially in the speedy termination of the tunnel; an argument made use of by General de Menabrea, in his interesting speech of the 4th of March last, to induce the Parliament to grant additional sums for the works, showing that to spend now is true economy, since every year gained will increase the proportion of the general expense to be borne by France. According to the calculations of the minister, twelve and a half years may be looked to with confidence as the ultimate term of the undertaking; in January last, the works were already 1,274 mètres, or rather more than a tenth of the whole distance, from the entrance on the side of Bardonnèche, and of this, 550 mètres (170 in 1861, 380 in 1862) were, owing to the mechanical system, which, there is every reason to hope, will every year afford increasingly satisfactory results, not less at any rate than a yearly progress of 400 mètres. At Fourneaux, where it was only inaugurated in January, 1863, at a distance of 925 mètres from the entrance, the progress made in the first two months was such as to afford ground for the confident expectation that the works on that side will soon be in as forward a state as those at Bardonnèche; and if these calculations be not falsified by encountering some fresh obstacle in the centre of the mountain, and the expected total advance of 800 mètres (400 at each end) be attained each year, it will follow that France will be liable by the treaty for a sum which will go far to acquit the obligations of the Italian Government with respect to the tunnel; since, including the interest on the sum spent on the French half, it will exceed 31,700,000 francs (£1,268,000). Besides this, an additional sum of 13,000,000 francs (£520,000) will have to be reimbursed by the Victor Emmanuel Railway Company, leaving little more than 20,000,000 francs out of the 65,000,000 francs the tunnel is computed to cost, to be finally paid by the Italian Government, in which sum is included the cost of the railway between Bardonnèche and Susa.

As long as the opening of the tunnel could be deemed problematical, it would have been idle to speculate on the advantages to be derived from its existence—advantages incalculably multiplied by the fusion of the greater part of Italy into a single State, blessed, moreover, with freedom of commerce. Less than twenty-five miles (forty kilomètres) of railway will suffice to connect the southern entrance of the tunnel with the iron net which covers the valley of the Po, and though the whole descent is little less than 2,500 feet, the engineers promise that in no part of this line, will the slopes exceed 27 per 1,000, nor will the curves have a radius of less than 500 mètres; and as only a sixth of this line will be underground, computing the whole of the eighteen tunnels of different lengths through which it will have to pass, we need not fear but what it will be completed in time to give its full value to the tunnel as soon as it shall be opened. On the northern side there are but a few miles of railway wanting to connect St. Michel, where it at present stops, with Modane, the works for which are already progressing, and we cannot doubt that the French authorities, who co-operate so heartily with the Italian engineers, that, as it is pleasant to hear from the report of the latter, not a single dispute has arisen in the course of three years, nor a day been lost to the works by the transfer of the province, will make it a point of honor to terminate them before the tunnel can be completed.

We are, therefore, safe in considering that as soon as the Mont Cénis tunnel is open, a train will be able to run direct from Chambéry to Turin. Let us now see what advantages this will imply: Chambéry, as most of our readers are doubtless aware, is in direct railway communication with Paris and Switzerland, and scarcely thirty hours distant from London, and when once the barrier of the Alps shall be broken down, the enterprising statesmen of Italy hope to see their country once more the high-road between Europe and Asia. For this purpose they are busily engaged in the construction of railways, and the repair and enlargement of long neglected harbors. Already a line of steamers is running between Ancona and Alexandria, the starting-place of which it is proposed to transfer to Brindisi (the Roman *Brundisium*), and perhaps in time to Taranto, when the

railway which now stops at Foggia shall be successively open to these ports, an event which may reasonably be expected to occur within a very few years, certainly before the completion of the tunnel. If we look to the consequence of this we shall find that when Brindisi is in direct communication with Boulogne, the journey from London to Egypt, and therefore to India, by this route, will be shorter by at least three days and nights than it ever can be through Marseilles, and that the sea passage will be reduced to less than half what it is at present. This fact only requires to be stated to give an idea of the great advantage this road will possess for the Indian mails, for passengers, and all the lighter and more valuable species of merchandise, in regard to which greater rapidity of transmission will more than compensate for any additional expense incurred by the substitution of railway for sea carriage, while as for travellers, we conceive there would be few unwilling to abbreviate a journey oftener undertaken from necessity than pleasure, and to substitute a railway route down the Adriatic coast for the constant tossing of the now inevitable Gulf of Lyons.

To our merchants, too, the opening of the Mont Cenis tunnel, and the railway system of which it may be regarded as the crown and keystone, should be a matter of no small interest, especially now that the commercial treaty just signed will entail a great reduction of the tariff. The southern provinces of Italy afford a field for commercial enterprise hitherto neglected, and necessarily so, from the utter want of means of communication between it and the rest of Europe; and yet, while Manchester mills stand idle for want of cotton, there is perhaps no soil more capable of producing it than the plains of Taranto and the southern shores of Sicily,\* while it would be tedious to attempt even the most cursory enumeration of the many objects of use or luxury that might be obtained from these rich but long-abandoned lands. The portals leading to them have now been closed by a barrier which seemed insuperable to human skill, and every day which brought places connected by the iron bond of the age more closely together, appeared proportionately to isolate and doom to atrophy all such

as had no part in the great community of interests.

All honor then is due to those who have rescued a country so fertile and so progressive as Italy from the moral and commercial suffocation to which she seemed condemned, by the Alpine girdle which cut her off from the rest of Europe, both to the engineers who devised, and the statesman who encouraged, the enterprise. In whatever light we look at the tunnel, it cannot fail to do the highest credit to Italian genius and Italian perseverance. Count de Cavour never lived to see the works which owed so much to his fostering care, for on the very 6th of June, 1861, which had long been fixed for him to visit Bardonnèche, and inspect the new machines in motion, the great minister expired; but while the department of public works is in the able hands of General de Menabrea, we may be very sure that nothing will be omitted to favor an undertaking of which he may justly be held one of the principal authors, owing to the share he took in the labors of the original Government Commission, and the zeal with which he has always upheld it, against every objection, both in the Parliament of his own country, and in the scientific assemblies of other nations.

For the directors of the works, and the engineers carrying them out under their orders, no praise can be deemed extravagant. The glory of utilizing a force hitherto without employment, and of contriving means for executing a work which seemed to defy the utmost resources of art, belongs entirely to the former; but the great merit of the latter cannot fail to be appreciated, if we consider the extraordinary difficulties with which they have had to contend. At no time, and in no circumstances, would the task of inaugurating an entirely new system of machinery, constructed on purely theoretical principles, the action of which was totally unknown, and whose every defect had to be discovered, and a remedy devised by the light of the experience practically acquired day by day, without any data, either in books or in engineering traditions, which could be of the slightest use as a guide, while a whole series of complicated manœuvres had to be taught to a large band of workmen all at once, have been an easy one; but in the case before us the inherent difficulties were incalculably increased by adventitious ones. They would

\* We believe that in the course of the winter it is intended to open an exhibition at Turin of this cotton cultivated in different parts of Italy

have been great enough in the centre of an industrial district, with workshops and tool manufactories close at hand, with a choice of intelligent mechanics, trained to turn their attention to different kinds of work—what must they have been in an Alpine region, buried in snow for nearly half the year, far away from even a village offering the smallest resource, with only such workshops on the spot as could execute small repairs or slight modifications in the machinery, while every alteration of real importance had to be made in Belgium by the original constructors? If we consider, moreover, that all the requirements, and the very daily subsistence of great numbers of workmen\* collected together from distant places had to be provided for—that bridges had to be built, and roads constructed, before even a cart could arrive at the scene of the works, besides the reservoirs and canals we have already mentioned, and that all this was accomplished in a country and by a nation among which all industrial enterprise had been unknown, and political and commercial liberty had only just sprung into life, we think it must be conceded that no panegyric can exceed the deserts of such men as M. Borelli, local director at Bardonnèche, and MM. Mella and Copello, who have successively occupied the same post at Fourneaux. It is indeed their highest praise to say that they have overcome difficulties like those we have briefly hinted at above, leaving it to such of our readers as are practically acquainted with engineering enterprises to appreciate their magnitude, and brought the works and the machinery to a state of such forwardness and perfection, as to make it possible approximatively to calculate the

\* On the 1st January, 1863, nine hundred workmen were employed at Bardonnèche, and seven hundred and twenty at Modane, a number intended to be increased during the past year.

time and cost still requisite to assure the completion of this extraordinary work.

All the persons concerned in it have given such proof of their capacity and energy, that it would be unjust to doubt that they will continue to the end equal to themselves, and we therefore look with confidence to their final success at the period they have assigned for the conclusion of their labors. The annual report the chief directors are bound to present to the Italian Parliament, and of which the one now before us is the first (since none could be made until the mechanical perforation had been sufficiently tried to attest its powers), must be looked for each spring with increasing interest, and engineers will be glad to learn that the present volume holds out a promise of a technical work already in course of compilation, giving a detailed description of the different machines and an account of their action, both in a theoretical and practical point of view, as well as accurate data, illustrating the phenomena connected with the compression of air, besides various studies on the use that may be made of it as an industrial force, which it is hoped may be given to the public in the course of the next two years.

To this future work, and in the mean while to the appendix of the present report, with its excellent illustrations, we must refer whoever wishes to acquire an exact knowledge of the state of the works under Mont Cenis, and especially of the means employed for boring the tunnel. If we have succeeded in giving our readers any clear general notion of this great undertaking, and of the vast commercial interests involved in its success, we have done all that lies within the province of a reviewer, and can but rejoice in having had the opportunity of paying our tribute of admiration to the men who are at once doing so much for the honor of the Italian name, and the advantage and prosperity of the world at large.

THE venerable Herr Fintelman, the King of Prussia's head-gardener at Charlottenburg, died on Christmas-day at the age of ninety. Those who have visited Berlin will recollect how he used to tell, with evident pride, that in his boyhood, when he was employed in the gardens of Sans Souci, Frederick the Great was wont to search out the largest and finest figs with his eyes, and, pointing to them with his cane, make him mount the trees and gather them for him. But, if he

spoke with pride of this occupation of his boyhood connecting his memories with the great king, he would tell with enthusiasm of the culture of the first dahlias, which Humboldt had brought over from America, and first introduced into Prussia. To old Mr. Fintelman the beautiful gardens on Peacock's Island, near Potsdam, the favorite resort of King Frederick William the Third, owe their chief attractions.

From The Saturday Review.

MR. THACKERAY.

A YEAR already remarkable by the deaths of conspicuous persons has closed with an unexpected loss. In the full vigor of his faculties, and in the midst of healthy hopes and projects, Mr. Thackeray has gone to join those who, in the old Latin phrase, are called with tender reticence the majority, or the many. Although modern feeling no longer deprecates sudden death as a peculiar evil to its victims, survivors feel most sensibly the unprepared blow which is concentrated into a single moment. The shock of the event must have been felt over large spaces of society, extending from the centre of friendship and intimacy to distant regions in which the character of the writer was only conjectured from his works. Even the colorless products of science and recondite learning include an element of human or biographical interest, and the literature which relates to daily life and to social manners is far more closely connected with personal relations. Whatever Mr. Thackeray wrote was obviously, and for the most part intentionally, tinged with individual peculiarity, and only the most careless readers can have failed occasionally to think of the author. The circumstances of his life, as well as his tastes and habits, brought him into contact with an extraordinarily large circle of acquaintances, and his striking personal appearance was still more widely known within and beyond the range of London society. By the friends who knew him best, Mr. Thackeray was thoroughly beloved, and in the due proportion of nearer or remoter intercourse he inspired an affectionate regard in all who shared his conversation. All competent observers who have been brought by merit or good fortune into contact with men of genius know that, notwithstanding innumerable diversities of character, they are almost always distinguished by a fundamental simplicity and nobleness of nature. The course of Mr. Thackeray's life was probably not unfavorable to his intellectual and moral development, but no perversity of training or exceptional obliquity of circumstances could have converted him into an intriguer, a fanatic, or a prig. Not affecting stoical elevation, liable to conscious and unconscious foibles, he satisfied the first condition of greatness or natural superiority by always remaining essentially the same. A certain large-

ness and passivity of disposition left room for the undisturbed play of his intellect and fancy. It was not his mission to guide the opinions of men, or to direct their practical energies. The gift of humorous observation and of dramatic reproduction is subtler and rarer, and it is not less really useful.

Superficial critics often attributed to Mr. Thackeray the bitter and sarcastic tendency which they imagined that they discovered in his writings. His friends, on the other hand, influenced perhaps by their knowledge of his personal character, received from his works an opposite impression. His satirical acuteness contrasted oddly, and yet pleasantly, with an invincible credulity in every form and every pretence of goodness. The hero of the day, especially if his merits were philanthropic or religious, always commanded his momentary belief and admiration. Innate diffidence or modesty inclined him to exaggerate the greatness of good men and of those who professed to be good. In real life, and sometimes in literary composition, he was unduly tolerant of impostors whom he was far too honest to imitate. The sarcastic quality of his writings represented the reaction of his judgment against his impulses, and it also arose, in part, from an almost feminine impatience of harshness and wrong. He might be said to be habitually angry because all the world was not as gentle and as genial as himself; and yet he was so far from entertaining excessive self-esteem that, if he could have denuded himself of his personality, he would probably have chosen an entirely different type of character, which would have been narrower and poorer than his own. If he had been a dull man, he would perhaps have submitted to the dictation of some presuming theorist or sectarian teacher; but a happy faculty of discerning absurdity secured him against the consequences of his unusual softness of disposition. To a certain extent, he was aware of his own amiable peculiarities, and several of his fictitious characters are partially copied from the simpler and less vigorous side of his own nature. The weakness which too often distinguishes the virtuous and benevolent personages of his novels indicates his unfounded suspicion that intellectual power is a moral drawback rather than an inappreciable advantage. He knew himself to be able and brilliant, and he never discovered that he was intrinsically good.

He once accepted as a compliment the half-serious remark of one of his friends, that the principal feature of his character was a weak religious sentimentality.

It was fortunate that Mr. Thackeray failed in his attempt, some years ago, to obtain a seat in Parliament. For politics, and in general for either abstract or practical controversies, he was incapable of caring, and his consciousness of his true vocation was characteristically displayed in his hearty congratulations of the successful adversary, who, as the defeated candidate informed his supporters, was better qualified for the House of Commons than himself. It would perhaps have been better if he had never meddled with history, for some kinds of greatness irritated and repelled him, and his strong perception of personal obliquities blinded him to the great public interests which were often identified with imperfect kings or statesmen. The Hanoverian succession, which perpetuated the liberties of England, was associated in Mr. Thackeray's imagination with a succession of coarse or insignificant German princes, who were less picturesque than the Pretender of tradition. The illustrious Marlborough seemed to him only an avaricious tyrant, and he would willingly have dwarfed Swift to the proportions of Addison, because the "Tale of a Tub" displays more questionable daring than scores of pretty verses about the spacious firmament and the blue ethereal sky. Even the form of genius which Mr. Thackeray might have been expected most heartily to appreciate was distasteful to him when he believed it to have been dissociated from moral worth. His irrelevant criticism on the faulty life of Sterne is substituted for the due recognition of a genius which, both in fiction and in humor, was even higher than his own. The few failings of his taste and judgment leaned to the side of virtue, and the delicate and almost timid sensitiveness of his nature explained and excused occasional injustice. It would be unfitting at the present moment to notice even petty defects, except for the purpose of explaining the paradox of a benevolence which sometimes seemed to require a cynical expression. Mr. Thackeray's friends were not perplexed by any similar inconsistency between his affectionate character and his kindly demeanor. The formidable satirist never sought to be feared either by his intel-

lectual equals or by the most commonplace of his associates.

His knowledge of character was minute and accurate, but it was confined to the limits of his own experience. He had lived among artists, men of letters, native and foreign adventurers, and in the best society of London; but he knew nothing of peasants or artisans, and he never attempted to describe them. The variety of his creations has been undervalued, because his later novels were too exclusively occupied with a single phase of existence; but the humble clerk who is the hero of the "Great Hoggarty Diamond" is removed by many degrees in the social scale from the Marquis of Steyne and Lady Kew. The artificial ingenuity by which accuracy of costume is preserved in "Esmond" and "The Virginians" might have raised a doubt of Mr. Thackeray's prudence in attempting historical fiction; but the "Luck of Barry Lyndon" contains an admirable picture of continental life in the last century, although the story has failed to obtain popularity in consequence of the error of making the villain of the story, like Smollett's "Count Fathom," also its hero or centre. In *Becky Sharp*, Mr. Thackeray performed a feat which has rarely been accomplished in fiction, by endowing the creature of his imagination with a portion of his own genius and wit. Perhaps the reality of life which is imparted to the thoroughly commonplace George Osborne is almost an equally difficult achievement. Caricatures, even when they symbolize whole classes by a skilful exaggeration of their peculiarities, rank below the natural and breathing portraits of the highest order of artists. In the power of arranging the accessories of scenery and incident Mr. Thackeray had many superiors, yet there is no more perfect passage in modern literature than the Waterloo chapter in *Van-ity Fair*, where the rumors of the unseen battle form an accompaniment to the anxieties and projects of the personages of the story, as they wait for the results at Brussels.

While the best parts of Mr. Thackeray's regular novels belong to the class of refined comedy, his Christmas stories, his contributions to *Punch*, and his minor writings in general, overflow with the gayest and wildest humor. No modern parodies approach in excellence to the imitations of Mr. Disraeli and Sir Bulwer Lytton in "Codlingsby" and

"George de Barnwell." The profound philosophy of the interesting murderer's argument to prove that he had committed no crime because he felt no remorse, is the more admirable because it approaches the limits of possible sophistry. Major Gahagan, "the slayer of elephants," furnishes a subject for one of the wittiest of burlesque romances. In "Rebecca and Rowena," where Mr. Thackeray vented his humorous irritation against the heroine of "Ivanhoe," his unfailing dislike to famous warriors is expressed in the melodramatic ferocity of Richard Cœur de Lion. Like all great comic writers, he derived a special amusement from certain favorite types of character. Of the mendacious Irish adventurer he was never tired, and Barry Lyndon was only the possible or credible forerunner of The Mulligan. The "Jeames" of the "Diary" and the "Charles" of the "Yellow-plush Papers" are still more fabulous representatives of the imaginary London footman; but Mr. Thackeray knew how to produce the most amusing results by adopting the gratuitous supposition that uneducated magniloquence was combined with a practice of phonetic spelling. He always took pleasure in playing with the language of which he had obtained perfect mastery. His puns and his unexpected rhymes were surprisingly ingenious, and the flowing metre of his humorous ballads was not far removed from the music of genuine poetry. His ordinary style was in a high degree pure and idiomatic, and his habitual cultivation of the niceties of language taught him to appreciate, in his maturer years, the classical studies

which he had too much undervalued in his youth. He sometimes said that his highest aspiration would be to produce a few short poems as finished and perfect as the Odes of Horace.

Detailed criticism would be ill-suited to the occasion, but the memory of a great writer is inseparably, and for the world at large exclusively, associated with his works. To those who knew Mr. Thackeray himself, it seems as if a sagacious stranger might construct his true character from a careful study of his writings. It would be evident that, while he had no pretension to learning, he possessed vast stores of miscellaneous knowledge, and that whatever he knew was available for his purposes. His gayety and melancholy corresponded to the humor of his fictions, and to the pathetic element which they contained. The acrimony of his satire was but the form in which a sensitive nature sought at the same time concealment and utterance. The most common error in his conception of character proceeded from an excess of charitable forbearance. He made his amiable women almost silly, not because he despised feminine virtues, but because he had taught himself to be tolerant of folly if he fancied that it was combined with goodness. Exaggerating to himself his own conscious failings, holding that intellectual gifts afforded no security for moral excellence, he scarcely knew how large a possibility of error is abolished by the elimination of stupidity. His survivors understand better the essential purity of character which was intimately connected with his sparkling fancy and with his keen observation.

#### *British Almanack and Companion for 1864.* Knight & Co.

THE Society for the Promotion of Christian Knowledge published the first of this valuable series of Almanacks and Companions in the year 1828; and to that volume we are indebted for the radical reform which has since taken place in all almanacs published in England from that period, up to which the Stationers' Company, enjoying then a monopoly for the production of these useful manuals, had made use of that monopoly chiefly as a source of revenue, supplying the most miserable farrago under the name of an almanac at the highest possible price they could reckon upon the public giving for it. The entire series of the "British Almanack and Companion," now consisting of thirty-seven volumes, is worth preserving on one's shelves as a constant book of reference; the Companion, in particular, contain-

ing abstracts of all important Acts of Parliament for each successive year, a short parliamentary history of the session, a great body of most useful statistics on interesting home and colonial matters, accounts of public buildings and improvements, and other information which one would have to hunt up in parliamentary blue-books, or collect out of newspapers, at a loss of time, patience, and often, too, of temper. The almanac itself contains all that an almanac may be expected to contain; and, in saying that the "British Almanack and Companion for 1864" is every way equal to its predecessors, we give it the fullest meed of praise that can be given. The two together, bound up in a single volume, furnish a manual of the social progress of the United Kingdom for the past year, and one of the best almanacs for the present.—*Reader.*

From The Reader.

### HENRY TAYLOR.

*The Poetical Works of Henry Taylor, D. C. L.*  
Three Volumes. Chapman and Hall.

THIS complete edition of Mr. Taylor's poetical works commences with the preface which, thirty years since, he prefixed to "Philip van Artevelde." In perusing it we are insensibly led to think of the veteran magistrate's advice to his successor, on no account to state the grounds of his decisions, and of Shelley's equally judicious warning:—

"It is a dangerous invasion  
When poets criticise—their station  
Is to delight, not prose."

Mr. Taylor does not, indeed, prose; his observations are sagacious, and his style delightful. But, in attempting to expose the errors of other poets, he has put criticism on the track of his own. We once heard a politician hold forth at great length on the advantage of admitting a certain class of voters to the franchise. When he had gone away, an old gentleman who had listened very quietly to the harangue composedly observed, "If they had votes, they would vote for *him*." Just in the same way Mr. Taylor's remarks might serve to apprise one who had never read a line of his writings that these would be found deficient in passion and that "ardent and affluent imagination" which is allowed by himself to form one of the principal constituents of genius. He has so ably pointed out the inefficiency of the imaginative faculty when unaccompanied by the chastening superintendence of Reason that we cannot avoid asking, How will Reason fare without Imagination? For a satisfactory reply, see his writings *passim*. It would be preposterous to contest his eminent merits, but it is equally impossible not to see that they are not those most essential to that branch of art to which he has devoted himself. Knowledge of the world is indeed an important auxiliary to the tragic poet, but it is not absolutely indispensable. Pity and terror may be excited without it; and poetic instinct, the inspiration which Plato enforces as the one thing needful, and Mr. Taylor derides as vain enthusiasm, will preserve from any gross solecism in the grammar of natural feeling. Pity and terror are rarely aroused by Mr. Taylor, for his own nature is by no means emotional, and, with all his censure of Byron, he resembles

the noble poet in the main source of his dramatic weakness—the essentially subjective character of his genius. Philip van Artevelde is as thoroughly identified with his creator as Manfred and Sardanapalus. He is undoubtedly a personage of superior mental force and moral worth, and would be more tragic were tragic heroes meant to be set up on a pedestal for admiration. On the contrary, nearly all the heroes of the stage are singularly mixed and imperfect characters, and tragedy itself consists less in stirring incidents than in the affecting contemplation of human inadequacy. In his preface and the play it precedes Mr. Taylor seems to consider it the business of the dramatist to produce a type of ideal perfection. He quotes Shakespeare's encomium of "that man that is not passion's slave," as if such were the character that Shakespeare delighted to exhibit. In reality, almost all his protagonists—Macbeth, Lear, Hamlet, Othello, Timon—are emphatically the slaves of passion in one form or another, and derive their tragic significance from this very circumstance. Brutus affords almost the only exception to this remark; and here Shakespeare was compelled to follow Plutarch. How widely he would have dissented from Mr. Taylor's views may further appear from his conduct of "Antony and Cleopatra." Mr. Taylor would have luxuriated in the opportunity of delineating the accomplished and successful statesman in Augustus, whom Shakespeare almost slurs over, while he devotes all his power to the exhibition of frailty and impotent passion in a pair intellectually and morally inferior to Byron's Sardanapalus. In Shakespeare's hands Philip van Artevelde would have excited quite a different kind of interest. Our interest for him, as he appears in Mr. Taylor's pages, is chiefly of an æsthetic character. We admire the vigor of the portrait, and are pleased to see the outlines gradually filled in by the hand of a master. For Artevelde himself we care little, for he does not want our sympathy. He can take excellent care of himself; his fall is not the consequence of amiable weakness, nor of imprudent magnanimity, nor even of an avenging Fate. The character is not naturally tragic, and Mr. Taylor could not render it so. He would have done better in selecting some theme that would have necessitated tragic sentiment, and would at the same time have been equally calculated to display his

statesman-like wisdom and knowledge of man. The downfall of Pompey would have afforded him an admirable subject. Pompey, Cæsar, Cato, Cicero, would have lived again in his masculine verse; and the overthrow of such greatness would have offered a theme on which he might easily have become pathetic.

It would be superfluous at this time of day to extol the merits of "Philip van Artevelde," or to dwell on the inferiority of the love-scenes. In "Edwin the Fair," on the contrary, Mr. Taylor's appeals to the more tender emotions are numerous and not unsuccessful. The play is full of bustle and spirit, richer than "Philip van Artevelde" in point of diction and sentiment; but the author has scarcely made enough of his principal character, who belongs to a class so alien from modern conceptions as only to be approachable through the medium of a very powerful imaginative sympathy. Generally speaking, the personages of this drama are less vigorously delineated than those of the former work; but the balance is made even by "Edwin the Fair's" superiority in poetic feeling and dramatic interest. Of "Isaac Comnenus" we need only say that it is a worthy prelude to an honorable career, containing the germ of almost all the author's subsequent excellence. "St. Clement's Eve" wants the epic element which enters so largely into Mr. Taylor's other tragedies. It is, accordingly, a purer model of the dramatic art, but less characteristic of his genius. In many respects it is an important advance on his former works; there is more feeling and less pedantry; and the character of Iolande at least shows real creative power. The great defect consists in the clumsiness of the means employed to bring about the catastrophe.

"A Sicilian Summer," we suppose, is an admitted failure. This is much to be regretted, for English literature would have gained greatly could Mr. Taylor have accomplished the task he proposed to himself. He would indeed deserve well of his country who should succeed in restoring the romantic and poetic comedy of the Elizabethan era. Mr. Taylor's perception of the want should earn him no less credit than the gallantry of his attempt to supply it. "A Sicilian Summer" may yet prove the happy germ of some more fortunate endeavor; meanwhile, we have much satisfaction in quoting two lyrical gems from this almost forgotten play:—

"Oh had I the wings of a dove,  
Soon would I fly away,  
And never more think of my love,  
Or not for a year and a day:  
If I had the wings of a dove.

"I would press the air to my breast,  
I would love the changeful sky,  
In the murmuring leaves I would set up my rest,  
And bid the world good-by:  
If I had the wings of a dove."

"The morning broke, and Spring was there,  
And lusty Summer near her birth;  
The birds awoke and waked the air,  
The flowers awoke and waked the earth.

"Up! quoth he, what joy for me  
On dewy plain, in budding brake!  
A sweet bird sings on every tree,  
And flowers are sweeter for my sake.

"Lightly o'er the plain he stept,  
Lightly brushed he through the wood,  
And snared a little bird that slept,  
And had not wakened when she should.

"Lightly through the wood he brushed,  
Lightly stept he o'er the plain,  
And yet—a little flower was crushed  
That never raised its head again."

THE will of Mrs. Wilyams of Tor Mohun, Devon, was proved on the 11th ult. at Doctors, Commons by Mr. Disraeli, the surviving executor. After leaving legacies to the amount of about £6,000, the residue of the personality, sworn under £40,000 along with her other property, is bequeathed to Mr. Disraeli; as the will is worded: "In testimony of my affection, and my approbation and admiration of his efforts to vindicate the race of Israel. With my views he is acquainted, and will no doubt endeavor to accomplish them." This legacy is therefore not left to the honorable member for Buckingham-

shire in admiration of his political, but of his literary career.

MESSRS. BACON have issued a "Federal Progress Map," which is an excellent map of the entire United States of North America as they were before the present war broke out, distinguishing by color—green, purple, and yellow—the territories claimed by the Confederates in 1861, the green at the same time showing how much of them has been recovered by the Federals up to December 31st, 1863. Much useful information is given in the shape of notes, and altogether this is one of the best war-maps published.

From The Spectator.

HANS CHRISTIAN ANDERSEN'S ICE  
MAIDEN.\*

HANS CHRISTIAN ANDERSEN'S tales are something more than tales for children, for their delicate humor and ingenuity of fancy will render them a permanent boast of the Danish national literature. No one who has once read his story of the foppish False Collar's flirtation with the prudish Garter (when they met in the washtub) can question his power of dramatizing the characters of the small and petty objects in the world around us in such a way as to strike some universal train of association (either with the names or the things of which he speaks, or with both), and so raise mere grotesqueness of conception into true humor. It is the same kind of fine humor which gives its character to this delightful little tale. The Ice Maiden herself, who is the presiding divinity of it, and is a mere impersonation of the terrible beauty and destructive fascination of Alpine frost, is more one of Andersen's poetical conceptions than of his humorous fancies. But the real humor of the tale lies in his constant interweaving throughout its course of the remarks of the domestic animals in the houses to which he introduces us, on the progress of the human events. He tells us in the first few pages that animals can only speak intelligibly to the very young:—

" 'Come out upon the roof with me,' the cat had said to Rudy, distinctly and intelligibly; for when one is a young child, and can scarcely speak, fowls and ducks, cats and dogs, are almost as easily understood as the language that fathers and mothers use. One must be very little indeed then, however; it is the time when grandpapa's stick neighs and becomes a horse, with head, legs, and tail. Some children retain their infantine thoughts longer than others, and of these it is said that they are very backward, exceedingly stupid children—people say so much! 'Come out upon the roof with me, little Rudy,' was one of the first things the cat said, and Rudy understood him. 'It is all nonsense to fancy one must fall down: you won't fall unless you are afraid. Come! set one of your paws here, the other there, and

\* "The Ice Maiden." By Hans Christian Andersen. Translated from the Danish by Mrs. Bushby, with drawings by Zwecker, engraved by Pearson. London: Bentley.

"The Ice Maiden, and Other Tales." By Hans Christian Andersen. Translated from the German by Fanny Fuller. Philadelphia: Frederick Leyboldt. London: Trubner.

take care of yourself with the rest of your paws! Keep a sharp look-out, and be active in your limbs. If there be a hole, spring over it, and keep a firm footing as I do."

And this is by no means the most distinguished cat in the story, which introduces in its later portion a periodic chorus, or, perhaps we should say, choral duet of cats—a recurring conversation between the parlor and kitchen cat at the miller's—on the progress of events. But the striking thing to notice is how finely Andersen picks out the characteristics of the different animals whose remarks he introduces. They all agree, indeed, more or less in a certain reticence of feeling and dislike to the sentimental ways of men. The hens don't like leave-taking; even the cat before quoted snubs Rudy when he bids him good-by, "for he did not wish Rudy to see how sorry he was." And the parlor cat says of the lovers, in a subsequent period of Rudy's history, "How those two do sit and hang over each other! I am sick of all this stuff!" This reserve, this jealousy of the lower animals towards the sentimental side of human nature, is not only a humorous, but in some sense a subtle trait. It is humorous, because it suggests that the reason animals don't display such feelings is not because they don't feel them, but because they put a strong control over themselves—and a cat escaping into solitude to suppress its emotion is certainly a very delicious idea. It is also subtle, because the analogy for the lower animals, in the development of such fancies as these, certainly ought to be taken from children, and children always show a marked dislike to the free expression of warm feeling, under that sense, perhaps, of the duty of reserve which is a part of the general feeling of immaturity.

But the finest stroke of humor in this charming little story is the broad difference made between the class of ideas which the dog entertains and those of the cats. The cats, with a general grudge of human self-importance, show a profoundly feminine interest in mere gossip and a delicate sense of social distinctions. Indeed, the parlor cat and kitchen cat meet at stated periods to gossip over the affairs of the family from the parlor and kitchen point of view, the kitchen cat being, perhaps, a thought *too* subdued under the oppression of her kitchen antecedents:—

" 'Don't you see there is something new

going on here?' said the parlor cat. 'There is secret love-making in the house. The father knows nothing of it yet. Rudy and Babette have been all the evening treading on each other's toes under the table; they trod on me twice, but I did not mew, for that would have aroused suspicion.'—'Well, I would have done it,' said the kitchen cat.—'What might suit the kitchen would not do in the parlor,' replied the parlor cat."

This is very good, and shows how lively is the feline sentiment of the *convenances*; but when the dog comes to open his heart on the themes which he has long laid up in his high mind, you see at once the more noble and universal nature of his meditations. He, like all of us, has begun his train of thoughts from the centre of his own adventures, mischances, and difficulties; but the circle widens at once from feline personalities into a general discussion of the universal order:—

"'Your father was the postilion and I was the postilion's dog,' said Ajola. 'We have often journeyed and driven, and I know both dogs and men on both sides of the mountains. It has not been my habit to speak much, but now that we shall have so short a time for conversation, I will say a little more than usual, and will relate to you something on which I have ruminated a great deal. I cannot understand it, nor can you; but that is of no consequence. But I have gathered this from it—that the good things of this world are not dealt out equally either to dogs or to mankind; all are not born to be in laps or to drink milk. I have never been accustomed to such indulgences. But I have seen a whelp of a little dog travelling in the inside of a post-chaise, occupying a man's or a woman's seat, and the lady to whom he belonged or whom he governed carried a bottle of milk, from which she helped him. She also offered him sponge cakes, but he would not condescend to eat them; he only sniffed at them, so she ate them herself. I was running in the sun by the side of the carriage as hungry as a dog could be; but I had only to chew the cud of

bitter reflection. Things were not so justly meted out as they might have been—but when are they? May you come to drive in carriages and lie in fortune's lap! but you can't bring all this about yourself. I never could, either by barking or growling!'"

This dog evidently had approached very near the so-called argument for a future state from the inequalities in the moral condition of the dogs in this, and the powerlessness of canine virtue to restore "either by barking or growling," the balance of unequal fortune. There is a comprehensiveness of thought, a loss of individual egotism, in this consideration of the general laws of the universe, as well as a stoical hauteur about it, which makes you feel at once the specific difference between the dog's point of view and the cat's. This is Andersen's great *forte*. He finds a myriad distinct voices for the myriad elements of natural and artificial life, and all of them contain some touch of delicate humor lent by his inventive and playful fancy. The snail in the last tale of the English edition, who despises the rosebush for *only* flowering, and imposes on her simplicity by thinking so much more of the world in himself than of anything in the world outside, is one of his happiest impersonations; but there is nothing with which men are familiar for which Hans Christian Andersen cannot find a characteristic voice.

The first translation of this tale mentioned below is made from the Danish (with which we have not, however, been able to compare it), runs very pleasantly in idiomatic English, and is very prettily illustrated. The second translation is an American translation made from the *German*, not illustrated, and, therefore, we conclude, much cheaper. It aims at a much greater literalness, but has obviously fallen into some errors in consequence, probably, of filtration through the German language.

From The Reader.

LADY HORNBY'S "CONSTANTINOPLE DURING THE CRIMEAN WAR."

*Constantinople during the Crimean War.* By Lady Hornby. Bentley.

This work, we are told by the publisher, is an extension of one called "In and around Stamboul," of which only a very limited number of copies was printed some few years ago. That volume has not only been remodelled, but has received considerable additions. It is also illustrated by many colored lithographs from the pencil of Mrs. Walker.

In August, 1854, Mr. Hornby was despatched to Constantinople as one of the commissioners deputed to control the proper expenditure of the loan granted to Turkey, and was accompanied by his wife, the authoress of the book before us. This lady remained six years at Constantinople, and occupied her abundant leisure in writing to friends in England descriptions of the curious people, manners, and customs, by which she was surrounded. Sir Edmund Hornby's official position, and the length of their residence in the East, enabled Lady Hornby to give a most minute and trustworthy account of a country which, though interesting in many respects, was but little known in England previous to the Crimean war. Her narrative, being contained in letters merely written for the amusement of relations and friends, possesses all the charm attendant on correspondence undertaken with no ulterior object. The letters are simple yet graphic accounts of what an educated, unprejudiced English lady saw and did. In them we never find any attempt at fine writing or to sacrifice truth to a love of effect. In fact, the only parts of the book which are highly colored are the lithographs.

The first view of Constantinople is often disappointing; as the authoress justly observes, "all this *must* be seen in sunshine to be believed in, and *then* you will think it a dream." Propitious weather spared her the pain of finding the reality inferior to long-cherished anticipations; and, in truth, unless the sky be adverse, anything more like the perfection of a panorama than Istanbul and the landscape in which it is placed can scarcely be imagined. Till you disembark you fancy yourself in fairy-land; but, the instant you set foot on shore, the narrow streets, badly paved, and with black open

sewers running down the centre, the mangy dogs, the miserable, tumble-down houses and, above all, the dreadful smell, soon bring you back to earth again, "confused, enchanted with the without, disgusted beyond measure at the within." From the top of Myserri's Hotel the authoress had a beautiful view, which she truly describes as being "almost too dazzling to be agreeable." Constantinople was at that time crowded with sick and wounded officers from the Crimea, and Lady Hornby listened eagerly to all the gossip she could hear respecting the grim struggle they had been engaged in. Some of this she inserts; but, to say the truth, necessarily tells us little that is new on that subject.

The dogs of Constantinople and its neighborhood are a wonderful as well as useful institution—useful from the fact that they are the only scavengers, and wonderful from their extraordinary organization. They seem to be divided into bands, to each of which a particular district is by tacit consent awarded. Some of these dogs are tolerably tame, and with food you may coax them with you all over their own district; but, the instant you reach the boundary, they stop, and, wagging their tails, and looking intelligently in your face, cannot be persuaded to move a step farther. The reason is that, directly they left their own territory, they would be attacked by the neighboring dogs, who would drive them to the very verge of their own district, where in their turn the pursuers would stop. Lady Hornby took a great fancy to one of these dogs, and was about to appropriate it, but unfortunately a French officer anticipated her. To console her, one of the officers of the Turkish Contingent organized a hunt for the purpose of catching another. The chase was successful, and Lady Hornby delighted, when her satisfaction was somewhat damped by a gentleman, who knew the East well, informing her that the new pet was not a dog at all, but a remarkably fine jackal. The most interesting part of the book is that which treats of the Turkish women. We extract the following passage, which gives a very true description of them:—

"As to beauty of mere dress and ease of attitude, nothing that I have seen in life or in pictures can give the slightest idea of the wonderful grace, the extreme delicacy, and bird-of-paradise-like uselessness of the Turk-

ish belle. Women of rank look like hot-house flowers, and are really *cultivated* to the highest perfection of physical beauty, having no other employment but to make their skins as snow-white and their eyebrows as jet-black as possible. When young, their skin is literally as white as their veils, with the faintest tinge of pink on the cheek, like that in the inside of a shell, which blends exquisitely with the tender apple-leaf green, and soft violet colors, of which they are so fond. The reverse of the picture is, that after the first bloom of youth is past, the skin becomes yellow and sickly looking, and you long to give the yashmak a pull and admit a fresh breeze to brighten up the fine features. A belle, and a beauty, too, the Turkish woman *must* be; for nothing can be more wretched than to see the poor thing attempting to walk, or to make herself at all useful. She shuffles along the ground exactly like an embarrassed parouquet, looking as if her loose garments must inevitably flutter off at the next step. The drapery which falls so gracefully and easily about her in a carriage, or while reclining on cushions, seems untidy and awkward when she is moving about. In fact, if she is not a beauty, and is not the property of a rich man, she is the most miserable-looking creature possible."

The picture of the pasha's young son at the Sweet Waters of Asia is very well drawn. The boy is shown us mounted on a little pony, and dressed in an English-shaped jacket and trousers of red cloth, the jacket heavily embroidered with gold; on his head a dark crimson fez, and over his shoulder a golden baldrick, supporting a jewel-hilted cimeter. Some musicians are playing their barbarous tunes, and the boy Turk rides listlessly up, and, leaning languidly on the shoulder of a black slave, listens for a few minutes; then languidly waving his hand, to show that he is tired of the occupation, he betakes himself to an *araba* full of ladies, who receive him with kisses and sugar-plums. Such are the rich here, enervated from their earliest youth.

Lady Hornby was fortunate enough to visit several harems, and in one of them spent a day and a night. The glimpses thus afforded into the rarely penetrated interior of an oriental family are interesting and well described. We have also to congratulate the authoress on the delicacy, by no means usual with travellers, which she has shown in omitting the names of those who accorded her their hospitality. On one occasion the harem

visited was that of a pasha who had been ambassador at Vienna. Lady Hornby was accompanied by two other ladies and a M. Robolli, this latter being a friend of the pasha. Arrived at their destination, M. Robolli went off to the pasha's apartments, while two hideous black eunuchs conducted the ladies to the harem. There they found the principal wife sitting on a divan in a vast room with carved domelike roof and gold-colored matting. At a window looking on to the Bosphorus, the Sea of Marmora, and the distant snow-capped Mount Olympus, with its slopes embroidered with ever-shifting shadows, sat the queen of the harem, plunged in a listless reverie, and surrounded by laughing female slaves. She was very beautiful, with strictly regular features, dark but clear skin, and "a brow and upper lip which would have graced a Roman empress." After shaking hands with her visitors, Madame Ayesha—as the authoress has christened her—led the way into a sort of Turkish boudoir. Even here, anything like a private interview was clearly impossible. Every moment more women would enter the room, and either stare, giggle, and run away, or coolly walk up to their mistress to talk about the strange visitors. Whilst this was going on, conversation languished sadly; neither can it be wondered at, when we learn that the visitors could only say "bono," or "no bono," and the hostess "oui," at which last word "all the slaves, black men included, laughed with pride at their mistress's accomplishments." The second wife, a most beautiful Circassian lady, who appears to have been on excellent terms with her colleague, then entered the room. Pipes were now threatened, greatly to the terror of Lady Hornby's companions. She herself rather liked the idea. Fortunately, the hostesses decided that, out of consideration for the prejudices of their visitors, tobacco should be omitted, and only coffee and preserves brought in. The impossibility of interchanging ideas by means of signs at last induced the Turkish ladies to send for M. Robolli to act as interpreter. A little consultation was required before this could be decided on; and, on the slaves laughing and running out of the room, the visitors began to fear they were about to be undressed, and two of them became very nervous. Their fears were soon dispelled by seeing the hostesses wrap their heads in shawls, and by the

appearance of M. Robolli, who, it must be mentioned, was an old man of seventy-five. After a time the interpreter was obliged to depart, for a Turkish female visitor now appeared on the stage. She entered the room with a Havana cigar between her fingers, and smoking with the air of a Rochester. A tambourine concert next exasperated the cultivated ears of the English ladies. After the concert came dinner, which was served in a most luxurious apartment, with "a European dining-table, a handsome centre-piece, and four beautiful vases of flowers, and fruit after the French fashion." The china was costly, the silver knives and forks very handsome, and the napkins extremely fine. The slaves stood round three or four deep, and a female jester, whose jokes threw the Turkish ladies into fits of laughter. Out of civility they all tried to eat with knives and forks, but soon gave up the attempt, and made use of fingers instead. The lovely Circassian lowered herself in Lady Hornby's estimation. "To see her lick her fingers up to the last joint after each dish—to see her lick her favorite tortoiseshell spoon bright after successive and never-to-be-believed enormous platefuls of sweet pancakes daubed with honey, and tarts too luscious for the Knave of Hearts,—this was too much for Venus herself to have done with impunity: we were perfectly disenchanted before the feast was over." Another edition of coffee and pipes concluded the visit.

On the occasion of a visit to another pasha's harem, some five years later, a most painful scene took place, which made a deep impression on the kind, feminine heart of the authoress. The Turkish ladies often buy little slave-girls on speculation, selling them, if they turn out beauties, at enormous profits. In this case a wild, high-spirited little Circassian, about ten years old, was brought in to be inspected, and was felt, examined, and discussed as coolly as if she had been a horse.

Once Lady Hornby received a visit from a Turkish lady at her own house, and greatly excited her guest's petulance because she

would not allow her to see Mr. Mansfield—Lady Hornby's cousin—in the room. She had set her heart on seeing an English gentleman in a room, and petulantly accused her hostess of jealousy. Lady Hornby considered that to grant her wish would be to break faith with the visitor's husband, and firmly refused. At last a compromise was agreed upon, and Mr. Mansfield was brought close to the open door, the Turkish lady having first put on her *yashmac*. According to Lady Hornby, the Turkish ladies are not deficient in maternal feeling, and are in every respect superior to the men. They are, however, grossly ignorant, many of them being unable even to read, and those who can having for their only literature the Arabian Nights and a book of Persian love-songs. Matters are, however, beginning to improve somewhat in this respect. Several Turks of rank are now anxious to obtain a certain degree of education for their daughters.

Lady Hornby justly observes that in Turkey the lower orders are far superior in uprightness, honesty, and noble qualities to those of higher rank, who are in as debased a condition as it is possible for men to be.

In the book before us are several interesting sketches of the Frank inhabitants, who are vulgar, ignorant imitators of the worst specimens of French and English; of festivities at the embassy; of a Greek wedding; of a visit to the Crimea; and of various other matters which want of space compels us to pass over without notice.

There are one or two faults of grammar, and several slight inaccuracies as to names, things, and places, etc., but none of sufficient consequence to detract from the great merit of this work. Since Lady Mary Wortley Montague, no female writer has given us such a perfect insight into Turkish domestic life as Lady Hornby has done; while the letters of the latter favorably contrast with those of the former in the entire absence of that coarseness which was Lady Mary's great blemish.

From *The Saturday Review*.

**KIRK'S HISTORY OF CHARLES THE BOLD.\***

THE history and the historical records of the Netherlands seem to have a peculiar attraction for American writers. The fortunes of those provinces are made the centre of interest in the accounts which Mr. Prescott and Mr. Motley have given of the great events which contributed so largely to the constitution of modern Europe; and it is to the systematic and diligent zeal of these writers in exploring the new sources of information about the Low Countries opened of late years, especially in Belgium, that much of the freshness and value of their works are owing. Mr. Kirk was a fellow-student of history with Mr. Prescott, and he, too, takes a subject of which, though it extends beyond the history of the Netherlands, that history is the foundation and the most important element. The house of Burgundy was a French house, with great French possessions; but its power and importance arose from its connection with the Netherlands, from its having ruled at Bruges and Brussels, and from its having been able to unite under one sway all the lordships and all the centres of industry and trade from Artois to Zealand. Mr. Kirk works in the same cycle of history as his two countrymen. He goes back into the period which prepared for the events which they relate. He describes the formation of that rich and splendid dominion, founded, but only for the profit of a foreign line, by the Dukes of Burgundy, of which Mr. Prescott describes the fate under the house of Austria, and Mr. Motley the break-up and dissolution.

Mr. Kirk has produced a work which is quite entitled to take rank with the writings of his two predecessors, with whom he has, both in his merits and his faults, a certain family resemblance. He has studied his subject, not only with patient industry, but with that strong sense of its pre-eminent interest and importance which seems almost disproportionate to a bystander, but which helps him to see and understand much that an equally learned but less enthusiastic student might have overlooked. His extensive and minute knowledge is the learning of a man of vigorous thought, accustomed to bring his

\* "History of Charles the Bold, Duke of Burgundy." By John Foster Kirk. 2 vols. London: Murray. 1863.

mind to consider men and things, not merely as they have been written about, but as they actually were, in the variety and complexity of their real existence. With such characters to deal with as Louis XI. and Charles the Bold, and with such a subtle master of the moral aspects of the time as Commines for his guide, Mr. Kirk has ample materials for the most remarkable pictures: and he shows himself competent to handle them. His conceptions of men are clear, discriminating, and well-sustained. When he is most disposed to generalize, he remembers, and allows himself to be checked by, facts at variance with the main effect of his judgment; and combinations and contrasts of qualities which do not ordinarily go together keep a character before us which suits no one but the person spoken of. Moreover, he pictures to himself the men in the scenes amid which they moved, and subject to the ideas and customs by which they were ruled. His imagination is active and impressible; it readily extracts from the monuments of past days the materials of lively delineations, and reproduces them in a shape which, in its completeness, its choice of important features, and its intelligible explanation of causes and motives, satisfies modern requirements as to the way in which a story should be told. Mr. Kirk, in his preface, modestly speaks of his work as if it only professed to be "an accurate and intelligent arrangement of the results of recent critical inquiry"—a "symmetrical narrative" of all that has been gained, not only from chronicles and histories, but from "memoirs and documents scattered among the publications of Royal Commissions and learned societies, written in various and often obscure dialects, and requiring for their comprehension a previous familiarity with details;" and from such a work, he says, "no one expects the artistic harmony, the unity and completeness, the agreement of form and substance, which give their highest charm to the products of pure imagination." But in this account of his work, and the implied disclaimer of the highest historical aim, Mr. Kirk scarcely gives a just representation either of what he has done or of what he has attempted to do. It is quite an understatement to say that his work is a mere bringing together, in convenient order, of dispersed or not easily accessible materials. The book shows that he has made a greater effort, and

sought to realize a much higher idea of historic art. On the other hand, it was a higher ideal than, as it seems to us, he has succeeded in realizing.

Mr. Kirk aims at writing with force and energy. He has felt the spell of Michelet and Mr. Carlyle, and, though his manner of composition is his own, he is of their way of thinking as to the way in which history should be written. He often says what he wants to say with great power, aptness, and effect; but the style which he has fallen into is hardly, on the whole, a successful one. It is rhetorical and diffuse; vigorous, careful, and not without eloquence, where the occasion calls forth the writer's strength; with a rough and unstudied directness when his feelings are touched, but, in the ordinary texture of the book, falling into verbiage, and a strained and declamatory prolixity. A style so florid, and pitched so high, requires a taste, precision, and accuracy which Mr. Kirk has not attained to. Perhaps, in an American writer, we have no right to complain of words which American judgment may have sanctioned; but such forms as "dampened," "to offset," "to liquidize," "to berate," "interlying," "eliminative" (with a very doubtful meaning), and "recuperative"—though for some of them analogy and authority (hardly necessity) may be pleaded—have an odd sound in a book of scholarly pretensions; and, for different reasons, his repeated recourse to "ovations" and "proclivities" has a still more unpleasant effect. Mr. Kirk's metaphors are apt to be intricate and far-fetched. We admit the license of historical irony, in which Mr. Kirk is fond of indulging, but we do not see what is gained by calling explorers of records "official mousers," or by presenting a Duke of Lorraine, when tempted to court the heiress of Burgundy, as a "less desirable gudgeon." And, as the jest is his own, we must say it is a rather clumsy one, when, speaking of the Emperor Frederick's shabby slinking away from his meeting with Charles, he tells us that "the vessel which bore Cæsar and his mis-fortunes floated down" the Moselle. A writer, too, who seeks to give force and effect to his direct statements by boldly and broadly touching, as he passes, a point lying out of his way, which shows the largeness of his knowledge or the vividness of his impressions, ought to remember that the whole effect of

such touches depends on their accuracy, and that blunders are especially dangerous where a rhetorical hit is to be made. In a work which deals largely in allusions and general statements, our trust in the writer is disturbed by being told that "Citeaux was the head of the great Carthusian order;" that a resident in Paris "watched the transport down the Seine of provisions brought to the capital from the adjacent parts of Normandy;" and that a certain learned writer had "apparently forgotten the 'non Angli sed angeli' of Pope Gregory VII." We are also perplexed when we find him speaking of three different places "forming the vertices of an equilateral triangle;" when he translates the old French "*mal-talent*" "maladroitness;" and when we find "the furious element pursuing the terror-stricken fugitives 'as if with talons'" given as the version of "*le feu suivoit les gens aux talons*" (at their heels) "de tous costés."

In spite of these blemishes and slips, and of a still deeper defect—the want of skill and power to control, condense, and proportion the materials for a large work—Mr. Kirk has unfolded to us, in increased light and interest, a very important period. His strength lies in bringing out the subtle play of opposite characters; and, next, in setting before us very distinctly and forcibly the course of a definite transaction. As long as the story runs along among the scenes and catastrophes of the struggle, we follow readily, and with interest. But, unfortunately as it seems to us, Mr. Kirk was not content with telling a story—with giving a narrative of events, and their immediate causes, connections, and results. His conception of his work seems too large for the subject of it—larger than the subject itself is calculated to support, and certainly larger than what, in fact, he gets out of his subject. He views the struggle between Charles and Louis as a great political crisis, involving great conflicts and changes of political ideas, and displacements of political power. It was the "last struggle which feudalism maintained with royalty—with the principles which were to form the basis of civil government and national unity during the three succeeding centuries." This manner of thinking about it gives breadth and philosophical dignity to a writer's view of a series of transactions; but it is an unsatisfactory generalization at the best, though

others besides Mr. Kirk, especially the French school, have adopted it; and it has the effect of distorting the plan of his work, by making him think that so great a revolution requires to be treated on a corresponding scale, and by misleading him as to the true import and bearing of his story. Except in some arbitrary interpretation of the term, feudalism survived both Charles and Louis, to be both the support and the danger of the French Crown. The feudalism of the fifteenth century was not the feudalism of the thirteenth; but Louis, as well as Charles, was a representative of feudalism, and depended on the ideas, the institutions, and the obligations of feudalism for his strength as King of France. Nor was Louis the first feudal king who encountered force with craft, and attempted to impose the curb of legal reason and administrative skill upon the violence and self-will of military nobles. Louis, in his notions of policy and methods of government, was doubtless an innovator. He aimed at centralizing; he saw the importance of finance; he attempted the beginning of a standing army; but so did Charles. That Charles tried to break loose from his allegiance to the French Crown, and create a new kingdom out of his many lordships, was not because he was imbued with the spirit of feudalism and wanted to maintain it against other tendencies, but because he was an ambitious and aspiring prince. The real interest of the story is not one of principles, but of persons. It is the contrast, not between the efforts and plans of obstinate but failing feudalism and those of aggressive and victorious royalty, but between the policy and achievements of an impetuous and violent soldier and those of a far-sighted and patient politician; and it is in this point of view that Mr. Kirk finds himself, in fact, obliged to treat his subject. He certainly succeeds in putting the two men before us in the clearest light and sharpest opposition; and, though he takes a good deal of space for what he wants to do, the result is in the end powerful and striking. But on the opposition and struggle of principles, social or political, we do not see that he throws any light whatever. It was by his personal qualities and his singular good fortune that Louis came off the conqueror, and the result of his victory was the consolidation of the monarchy, and the addition to it of provinces which had been fiefs. But Mr. Kirk fails to

show us with any sufficient distinctness what the qualities or the fortune of either Charles or Louis had to do with the reaction, the last struggles, and the defeat of feudalism. Except so far as we vaguely suppose that we see the violent temper of feudalism in the one and the more astute temper of modern government in the other, the treatment of the history as a contest between feudalism and royalty is misleading.

The course of the history, indeed, as it is actually presented to us, and Mr. Kirk's keen and truthful appreciation of real facts as they occurred, correct this misapprehension. But the supposed necessity of viewing the subject in a philosophical way, of pointing out its more general and its less obvious bearings, of putting it into its true place among the great experiences of European history, and using it to test or to illustrate social and political theories, have led Mr. Kirk into a great deal of writing, the lengthiness of which is not compensated by any adequate amount of new and instructive reflection. He is acute, observant, and thoughtful; but it requires more than this to sustain the reader's interest through digressions and disquisitions, suggested it may be by the story, but not wanted to explain it, and interrupting it where perhaps its continuous course furnishes the best explanation of it. It requires something very original, very profound, very comprehensive and lucid, to reconcile us to a pause in the struggle between Charles and Louis, that we may review generally the political tendencies of the Middle Ages, the origin of monarchy in modern Europe, and the true way of judging of the influence of standing armies in constitutional governments. That Lord Macaulay was able successfully to interweave such discussions into his history is no reason why every other clever historian should emulate him; and when such discussion is not only not necessary, but irrelevant, the reader has a greater grievance. No doubt a history of Charles and Louis must touch on contemporary English politics; but we do not see that half a chapter on the Wars of the Roses is therefore in place. Nor is the digression the less wearisome because it gives Mr. Kirk an opportunity to lay down some general axioms about English history, such as that it has, "from all ages down to the present time, exhibited a continual series of

revolutions," to remark on the inferiority of English historical records of this period to foreign ones of the same age, to tell us that the "guide-posts of English history" at this time are mostly false; and to suggest that the first step towards a real knowledge of it should perhaps be "to throw the so-called English chroniclers out of window."

Mr. Kirk, who has no sympathy with what he supposes Charles's cause, has the same sort of admiration for Charles's character and life which Republicans out of Europe are said to have felt for the Emperor Nicholas. Charles, like the czar, was the representative of an indefensible and doomed system; but he represented it grandly. The system was a frightful one—selfish, cruel, insolently regardless of the good of man, of all the rights and moralities and sanctities of human life; and he did not shrink from carrying out the system. But he had virtues which even ambition, injustice, pride, and barbarity could not obscure. Mr. Kirk tells at full length, and as it never was told before in English, the piteous tale of Dinant and the great city of Liège, destroyed from off the face of the earth after the fashion of Eastern conquerors, to assuage the wrath of Charles. He transcribes in full the speech of Charles to the Estates of Flanders, unmatched, perhaps, among the insolent words of princes, for its audacious and overbearing defiance of acknowledged rights. He goes fully into all Charles's schemes for making his daughter the price of arrangements which should open to him the path to the imperial throne. Yet Mr. Kirk's imagination can hardly resist the fascination of Charles's strength of soul and loftiness of purpose. In an age and a country of unbridled profligacy, he was sternly self-commanding. Terrible in his vengeance, he was rigorously just in the ordinary administration of law, and an exception to all the soldiers of his day in his inexorable severity of discipline, and in his care for the protection of women; and, great as were his designs, they never tempted him to betray an ally, though he may have refused to be bound by an engagement to a treacherous enemy. Steadfast, resolute, serious, proud beyond the measure of man, unscrupulous, but not a dissembler—with no great compass of thought, but clear and direct in his views and plans—irritable, melancholy, overshadowed by a presentment of an early end to his glory, and one which

in its bitterness and shame should avenge the blood shed at Dinant and Liège—he has as his contrast and foil the wily, mocking, even-tempered Louis, accepting failure and mortification with laughing resignation, never from idle self-respect struggling vainly against inevitable humiliation, but astonishing the world by the vivacity, the self-possession, the completeness with which he went through with it. In the king we have a tentative and experimental schemer, inexhaustible in expedients, delighting in the mere exercise and amusement of overreaching and entrapping, and rapidly, almost from sheer restlessness and fertility of imagination, exchanging one device and train of policy for another: but all the while—amid all this outward show of instability, of indifference to appearances and custom, of cynical amusement, of gay and light-hearted volubility, of insensibility to a shame which would have broken the spirit of any other prince—he is devoted inwardly, with immovable purpose, to one great political end, to which many different roads might lead and might have to be tried—the making himself master in France; the first and indispensable step to which was the ruin of the Duke of Burgundy.

The present volumes only go down to the beginning of the Swiss war. This is the part of the story on which Mr. Kirk demands an entire reversal of the ordinary judgment against Charles. The overthrow of his ambition by Swiss patriotism and valor is one of the commonplaces of history. Mr. Kirk undertakes to make out that Charles was absolutely innocent of any wrongs to the Confederacy, and that the quarrel of which Morat and Granson were the end was the sole result of the matchless craft of Louis to destroy him. Ordinary history has done Louis injustice, and not given to the artist the full glory of his great stroke of genius; and Mr. Kirk delights in the opportunity of repairing the injustice. The Swiss were the unprovoked, the treacherous aggressors; and they quarrelled with their old and stanchest friend; they gave up their old policy of isolation, to enter into a league against Burgundy, as the mercenaries of Louis. There is absolutely no trace, Mr. Kirk maintains, of any the most distant design on Charles's part against Swiss independence or Swiss rights. There is, he contends, the most abundant proof of the intrigues of Louis to reconcile Sigismund of

Austria to his old enemies the Swiss Confederacy, and there is clear evidence of the way in which the Swiss agents of Louis employed his representations, his promises, and his money to induce the Cantons to join in an alliance which, when once formed, was immediately put in motion against the unsuspecting and unoffending Duke of Burgundy. Mr. Kirk makes out a strong case, but it is manifestly an *ex parte* case. He certainly puts out of sight all that the world at that day saw and thought of Charles's policy. On Mr. Kirk's own showing, Charles, when the powers of the Upper Rhine declared against him, was preparing on the Lower Rhine, in the Electorate of Cologne, a basis for establishing his power on the river. Again, the Burgundian rule in Alsace, under Peter Von

Hagenbach, was what stirred and quickened the fear and hatred of his Swiss and German neighbors. Mr. Kirk thinks Hagenbach's atrocities exaggerated. This is possible; but if they are to be disbelieved because Hagenbach made many enemies, the worst men have a great advantage given them in history. Mr. Kirk has opened an extremely important view of the events which led to the downfall of Charles, but his account has strong internal improbabilities, and his chain of evidence is by no means complete or conclusive. A judgment on the question as well-informed as his, but more impartial and comprehensive, is needed before the view which he sets before us of Charles's entire innocence, and of the flagrant corruption and baseness of the Swiss Confederacy, can be accepted.

## MILES O'REILLY ON THE "NAYGURS."

[At the banquet to the Irish Brigade, recently, the following song, by Private Miles O'Reilly, was sung, to the air of "The Low-Backed Car," and received much applause.]

SOME tell us 'tis a burnin' shame  
To make the naygurs fight;  
An' that the thrade of bein' kilt  
Belongs but to the white;  
But as for me, upon my sowl!  
So liberal are we here,  
I'll let Sambo be murdered in place of myself  
On every day in the year!  
On every day in the year, boys,  
And every hour in the day,  
The right to be kilt I'd divide wid him,  
An' divil a word I'll say.

In battle's wild commotion  
I shouldn't at all object  
If Sambo's body should stop a ball  
That was comin' for me direct;  
And the prod of a Southern baynet,  
So liberal are we here,  
I'll resign and let Sambo take it  
On every day in the year!  
On every day in the year, boys,  
An' wid none of your nasty pride,  
All my right in a Southern baynet prod  
Wid Sambo I'll divide.

The men who object to Sambo  
Should take his place and fight:  
And it's betther to have a naygur's hue  
Than a liver that's wake and white;

Though Sambo's black as the ace of spades,  
His finger a thrigger can pull,  
And his eye runs sthraight on the barrel-sights  
From under its thatch of wool!  
So hear me all, boys, darlings,  
Don't think I'm tippin' you chaff  
The right to be kilt I'll divide wid him,  
And give him the largest half!

Among the articles recently discovered at Pompeii, says the *Chronique des Arts*, is a small head of Juno, in silver, of exquisite workmanship; also the body, in silver, but broken; a bridle-bit in bronze: a lamp in the same metal complete, with cover, suspending chain, and extinguisher; a patera; a large and handsome vase, with the handles terminated by winged genii holding a cornucopia; other small vases in bronze; and a seal in that metal bearing the name of the master of the house in which the articles were found — Lucio Cornelio Diadumeno.

"L'INTENDANT Ralph, et autres Histoires, par Miss M. E. Braddon," is a collection of Miss Braddon's smaller tales translated into French by M. Charles Derosne.

"Les Etats Confédérés d'Amérique, visités en 1863; Mémoire adressé à S. M. Napoléon III.," is the title of M. C. Girard's semi-official pamphlet, just published at Paris by Dentu.

From The N. Y. Tribune, 13 Feb.  
THE GOSPEL IN EGYPT.

Correspondence of the Tribune.

DONGOLA, ILL., Jan. 20, 1864.

Nor long since I received a call from a popular preacher. During the week he works at wagons. When he prepares his sermons I do not know. He always has large congregations. I have always taken him to be a harmless, inoffensive man. I have felt a little bitter toward him for some time, because, in fitting a couple of wagon-wheels for me, he used such poor timber, which was rails, and made such loose joints that, under a moderate load, one wheel broke down, and the other is likely to give away at any time. However, the ten dollars I paid him must be considered so much in support of the gospel, though most of it was in coffee.

It was Saturday afternoon, and I saw, at a glance, that it was a particular visit, for the bosom and collar of his shirt had more blueing in them than for every-day wear. It is likely that he called because I went to hear him preach the previous Sunday. On that occasion his text was from 2 Samuel, 22: 34: "He maketh my feet like hinds' feet, and setteth me in high places." As he could not read very well, he had mistaken "hinds" for "hens," and, upon this reading, he built his discourse, going on to show that as the feet of hens are made to hold fast to a stick or to the branch of a tree, they sleep securely, while without such feet they would fall off. So it was in Christian life; the feet are faith, the branch is the promises which are taken hold of, and by this means the Christian is, according to the word, "set up in high places;" and though the rain may fall, and the wind blow, he is safe. For more than half an hour he enlarged on the text in this manner, while his hearers wondered at his ability to explain the Scriptures. For some weeks before I had been sick; in fact, had the ague, and had gone to meeting hoping to feel better; but the seats were slabs, with no backs, and one of the legs came up through so very near where I sat, that my back almost gave out, and would have wholly done so had I not been interested in the sermon.

We soon became sociable. In speaking of some deserters who had gone to Canada, he said there was quite a dispute in some settlements, and he asked me how it was, for he thought I knew, "Is Canada a Slave

State, or is it not?" Again, speaking of himself and his preaching, he said he did not compare himself to St. Paul, because St. Paul understood English Grammar, and he did not. Some people are likely to think that I make up these and other things I have written about the ignorance here, but I assure them they are true. Let one live here only a short time and he will see they are so.

After a little our preacher said: "I am told you have a power of books; if you've no objections I would like to look at 'em. I think a heap of larning and of them as is tryin' to git edication." There was no objection. I have only about two hundred volumes; he probably never saw so many in all his life, but he glanced over them almost as if he had written them. Nothing is more common with such men than attempts at appearing to know everything, and if called upon for an opinion, they will ask questions implying that they are wholly acquainted with the matter; but they will slyly wait till they get the answer from you, then they repeat it, and add, "Oh, yes, that's right—I always knew it." I confess I was taken a little aback by the swift, careless rolling of his eyes, and by his suddenly taking down a book, flirting over the leaves, and then putting it back, but I thought it would be no harm to test him a little. I had among a few similar books, a copy of Finden's Moore, printed in London, on costly paper, elegantly bound, and intended to illustrate the female characters of this poet. On the left-hand page is the picture of a beautiful lady, on the opposite page a few lines of verse, in large, clear type, from which the artist drew his design. Of these there are some fifty or sixty, all finely engraved. Seeing that his hands were clean, I reached him the book, telling him it was a very choice one, that it cost so many dollars, and that I did not show it to every one. After he had looked it over a spell, and, as I clearly saw without being at all attracted by the engravings, he said that if he had time to read, this would be the very book he wanted, for he could get many things from it in preparing his sermons. I had no doubt of his sincerity, and that he came to this conclusion because the letters are large and the reading seemed easy.

He soon got through looking at the book, then taking a seat, he arranged his shirt-col-

lar, brushed up his hair, as if a little embarrassed, and said that his business in coming to see me was to get me to become a preacher. Of course I started at this; but he was fully prepared to urge the matter, and he told me how much good I could do with my learning, how souls are perishing, and how the harvest is ripe. All I needed to start with was a little more knowledge of the Scriptures, which I could get by reading them, and from the preachers; in fact, he himself would tell me all he knew; and if I would only try, in a few months I would become one of the first preachers in the country.

I told him I had read of One who beside being a Preacher was also a Doctor, and I always thought it would be an honor to any one to imitate him, but I was afraid that if I should try to do so I would get into trouble.

"I guess not," said he; "but if doct'r in's a part on't, you've got a heap o' that already. Did he live hur, in Eelinoi, or up to the Northud, whar you come from?"

"No, he lived in the East."

"Oh, yes, a Yankee like you is. What did you say his name was?"

"I have never seen him; I only read of him."

"Was it Wesley?"

"I think not. A good many years ago I first read about him in a book a little hard to understand, it seems. Though he preached both Sundays and week-days, he was thought so much of as a doctor that they sent for him a good many miles, and he had a very great practice."

"Calomel, or steam?"

"That is not known, for his medicine seldom was seen."

"Was it a harsh medicine?"

"Very mild."

"'Twouldn't do for this country. The liver's what's the matter with us, and nothin's so good for this as blue mass. 'Pears like he was a smart chap. He didn't preach from no notes, I reckon."

"I cannot say how this was; but in the short reports we have of his sermons they seemed carefully studied, and every word was in its proper place."

"That don't 'mount to shucks," said the preacher. "I remember, it's now onto two year, I had a 'pintment to preach in old Jonseboro, for the fust time, and as there is a power o' lawyers, marchants, and sich lar-

need men in that town, thinks I to myself, and says I, I must show 'em what a sarmon is, and I will, and if for nothin' more than to do honor to old Union County, and I picked out my tex, airly Monday morning, not intendin' to do a lick o' work all the week, and I didn't, for every mornin' I went out away off into the woods, and into a big sink hole, and I said, this rock is the cheer, and them trees is the lawyers, and I took my tex, and then I preached, sometimes one way, sometimes t'other, till I got the fust part as I wanted it, and I said, *You're* all right; I'll preach you; and so I went on till I got 'em all right; then I put 'em together and preached 'em together, and I thought I had 'em as they order be; I thought I had the best sarmon as ever was preached, and I don't know but I had; but, you see, when I got into the school-house, which was choek full, and I'd prayed and gin out the himes, and took my tex, and got a little way, jest as I had it, things got kinder tangled, and I made the fifth part come afore the second part, and I told a part of an antidote I'd told afore, and they was a beginnin' to laugh, when, seeing what a scrape I'd got into, I jest threw it all away, and preached as I'd allers preached, when I felt free, and I never was so happy in my life; and when I got through they was so solemn you could a heard a pin drap. But I don't want to interrupt you with no long stories. Go on about the Preacher."

"Yes. In doctoring he made out well enough—nobody found any fault with him; but in preaching he got into difficulty. More than this, he was poor and had no influential kin folks to help him, so that only the poorest people cared much about him; and in all his preaching there were only two or three large planters who liked him, and these were afraid to have it known. To show you what kind of doctrine he preached I will say that in the first sermon of which the book gives an account, he said that the Lord's Spirit was upon him, that he had been anointed to preach to poor folks, so that he could cure those whose hearts were broken, that he might preach liberty to the captives, to cure sore eyes, and set at liberty anybody that was hurt."

"Just as I expected," interrupted the preacher, "a preachin' liberty to the captives, which means slaves. We had them kind down in Alabam, and every one on 'em was an

Abolitioner—a black-hearted Abolitioner; but they soon got enough on it. That's the way they all talk. Only think of a man calling himself a preacher, and a sayin' he's anointed to preach sich stuff, when the Bible says, 'cussed be Canan'—which is niggers, which God made to be slaves—slaves allers. What did you say his name was? May be I hearn of him down in Alabam."

"I hardly think you ever heard of him. If you did, you seem to think little enough of him."

"In course I don't think nothin' of him. But what become of him?"

"Well he preached this kind of doctrine two or three years, and a good many got to going to hear him, and he kept doctoring, too, and going to see whoever sent for him; but it was the sermons which made disturbance, and so much disturbance that they wouldn't let him preach in the meeting-houses, till at last, as he was camping out

one night, they got a hold of him. They had a kind of a trial right away, and, though the law was on his side, they took off his clothes and spit on him, and whipped him, and then fastened him up to a tree till he died."

"Sarved him right! sarved him right!" said the preacher. "All sich orter swing. They've done wus nor that down South; they burnt 'em; yes, they burnt 'em. It kinder seems to me I hearn of this very feller afore I come away. Was't Woods, or Larkins, or Henshaw? One or t'other, I reckon."

"Yes, you must have heard of him. It would be singular if you had not. His name was Jesus Christ."

The preacher started up, red with rage; he seized his hat, and, departing, said,—

"I don't want to have *nothin'* to do with you! I don't want to have *nothin'* to do with you! I don't want to have *nothin'* to do with you!"

N. C. M.

**CHINESE CRUCIFIXION.**—The following account of a recent crucifixion in China is by Mr. James Jones, of Amoy, who witnessed the execution on the 28th October. The victim was a well-known thief, whose principal offence was that of stealing young girls and selling them for prostitutes. On his trial before his judge he refused to criminate himself, although repeatedly scourged until his back was raw. If a female witness fails in giving satisfactory evidence in a court of justice, she is beaten with a leather strap across the mouth. His wife, desirous of sparing her husband, refused to give evidence, but after two or three applications of the strap her courage gave way. She confessed his guilt, at the same time admitting that two hundred dollars of the money so derived was hidden in the sea near the beach. Officers were sent to search, and finding the dollars in the place indicated, the prisoner was sentenced to decapitation—deemed by the Chinese the most severe of punishments, because they imagine that if a man leaves this world *minus* any of his members, he appears in the same condition in the next. The culprit therefore prayed to be crucified instead of being beheaded. The cross was of the Latin form, the foot being inserted in a stout plank, and the criminal, standing on a board, had nails driven through his feet, his hands stretched and nailed to the cross-beam. His legs were fastened to the cross with an iron chain, and his arms bound with cords, and on the cord round his waist was inserted a piece of wood on which was written his name and offence; a similar piece on his right arm contained his sentence—namely, to remain on the cross day and night until he

died; another on his left arm had the name of the judge, with his titles and offices. The criminal was nailed to the cross inside the Yamun in the presence of the magistrate, and then carried by four coolies to one of the principal thoroughfares leading from the city, where he was left during the day, but removed at night inside the prison, for fear of his friends attempting to rescue him, and again carried forth at daylight in charge of two soldiers.

He was crucified at noon on the Wednesday, and Mr. Jones conversed with him at five in the evening. He complained of pain in the chest, and thirst. On Thursday he slept for some hours when the cross was laid down within the gaol compound. No one was allowed to supply him with food or drink, and during the day there was quite a fair in front of the cross, people being attracted from a distance, and the sweetmeat vendors driving a large trade. On Saturday he was still alive, when the Taotai was appealed to by a foreigner to put an end to the wretch's sufferings and he immediately gave orders that vinegar should be administered, which he expected would produce immediate death, but the result was otherwise, and at sunset, when the cross was taken within the gaol, two soldiers with stout bamboos broke both his legs, and then strangled him. Mr. Jones says that all the Chinese with whom he has conversed assert that crucifixion is a modern punishment; and looking at the similarity of passages in the execution with the narratives of the New Testament, he conceives the idea may have been introduced through the Jesuits.

## SUSPIRIA ENSIS.

MOURN no more for our dead,  
Laid in their rest serene;  
With the tears a Land hath shed  
Their graves shall ever be green.

Ever their fair, true glory  
Fondly shall fame rehearse—  
Light of legend and story,  
Flower of marble and verse!

(Wilt thou forget, O Mother!  
How thy darlings, day by day,  
For thee, and with fearless faces,  
Journeyed the darksome way;  
Went down to death in the war-ship,  
And on the bare hillside lay?)

For the Giver they gave their breath,  
And 'tis now no time to mourn;  
Lo, of their dear, brave death  
A mighty Nation is born!

But a long lament for others,  
Dying for Darker Powers!—  
Those that once were our brothers,  
Whose children shall yet be ours.

That a People, haughty and brave,  
(Warriors, old and young!)  
Should lie in a bloody grave,  
And never a dirge be sung!

We may look with woe on the dead,  
We may smooth their lids, 'tis true,  
For the veins of a common red  
And the Mother's milk we drew.

But alas, how vainly bleeds  
The breast that is bared for crime!  
Who shall dare hymn the deeds  
That else had been all sublime?

Were it alien steel that clashed,  
They had guarded each inch of sod;  
But the angry valor dashed  
On the awful shield of God!

(Ah—if for some great Good—  
On some giant Evil hurled—  
The Thirty Millions had stood  
'Gainst the might of a banded world!)

But now to the long, long Night  
They pass, as they ne'er had been—  
A stranger and sadder sight  
Than ever the sun hath seen.

For his waning beams illume  
A vast and a sullen train  
Going down to the gloom—  
One wretched and drear refrain,  
The only line on their tomb—  
"They died—and they died in vain!"

Gone—ah me!—to the grave,  
And never one note of song!—  
The Musp would weep for the brave,  
But how shall she chant the wrong?

For a wayward wench is she—  
One that rather would wait  
With Old John Brown at the tree  
Than Stonewall dying in state.

When, for the wrongs that were,  
Hath she lifted a single stave?  
Know, proud hearts, that, with her,  
'Tis not enough to be brave.

By the injured, with loving glance,  
Aye hath she lingered of old,  
And eyed the Evil askance,  
Be it never so haught and bold.

With Homer, alms-gift in hand,  
With Dante, exile and free,  
With Milton, blind in the Strand,  
With Hugo, lone by the sea—

In the attic, with Béranger,  
She could carol,—how blithe and free!—  
Of the old, worn Frocks of Blue  
(All threadbare with victory)!\*  
But never of purple and gold,  
Never of Lily or Bee!

And thus, though the Traitor Sword  
Were the bravest that battle wield—  
Though the fiery Valor poured  
Its life on a thousand fields—

The sheen of its ill renown  
All tarnished with guilt and blame,  
No Poet a deed may crown,  
No Lay may laurel a name.

Yet never for thee, fair Song,  
The fallen brave to condemn:  
They died for a mighty Wrong—  
But their Demon died with them.

(Died by field and by city!)—  
Be thine on the day to dwell,  
When dews of peace and of pity  
Shall fall o'er the fading hell—

And the dead shall smile in heaven—  
And tears, that now may not rise,  
Of love and of all forgiveness,  
Shall stream from a million eyes.

U. S. N.

Flag-Ship Hartford, at Sea, Jan., 1864.

—*N. O. Times*, Jan. 24, 1864.

\* "Des habits bleus par la victoire usés."

## THE DIAMOND.

From sandy streams in India's clime,  
A pebble oft is brought  
Which, valueless to trivial sight,  
The practised eye has sought.

Unpolished, rough its outward form;  
Yet, from the matrix there,  
The diamond is brought to light  
By lapidary's care!

Radiant as beauty's face unveiled,  
Worthy her diadem,  
Like dewdrops from the heavens distilled,  
Condensed into a gem:

Such is the Christian — he whom men  
Would pass unheeded by,  
And lightly scorn the precious gem,  
Concealed from human eye.

But God his jewels can perceive,  
Though wrapt in rudest guise;  
And place them, freed from earthly dross,  
Resplendent in the skies.

F. DRIVER.

—*National Magazine.*

## THE SOUTHERN CHURCH.

[In one of William Gilmore Simms's poetical works, occur the following rather striking stanzas expressive of the present state of the Church in some of the rebel towns.]

THE Church, like some deserted bride,  
In trembling at the altar waits,  
While raging fierce on every side,  
The foe is thundering at her gates.  
No ivy green, nor glittering leaves,  
No crimson berries deck her walls;  
But blood, red dripping from her eaves,  
Along the sacred pavement falls.

Her silver bells no longer chime  
In summons to our sacred home;  
Nor holy song at matin prime  
Proclaims the God within the dome.  
Nor do the fireside's happy bands  
Assemble fond, with greetings dear,  
While Patriarch Christmas spreads his hands,  
To glad with gifts and crown with cheer.

## BABY MARGUERITE.

MARGUERITE,  
Fairest flowers are called like thee—  
Flowers that bloom in trinity  
Of faith and love and purity.

Marguerite,  
Sure that name the symbol is  
Of the worth and wealth of bliss  
That without thee we should miss.

Marguerite,  
Best of all our blessings sweet!  
Let us all pray to be meet  
To enter heaven with Marguerite.

## MARCHING SONG OF THE "FIRST OF ARKANSAS."

[The following song was written by Captain Lindley Miller of the First Arkansas Colored Regiment. Captain Miller says the "boys" sing the song on dress parade with an effect which can hardly be described, and he adds that "while it is not very conservative it will do to fight with." Captain Miller is a son of the late ex-Senator Miller, of New Jersey.]

Oh! we're de bully soldiers of de "First of Arkansas,"

We are fightin' for de Union; we are fightin' for de law;

We can hit a rebel farder dan a white man eber saw,

As we go marching on.

Glory, glory, hallelujah, etc.

See dar! above de centre, where de flag is wavin' bright;

We are goin' out of slavery; we are bound for freedom's light.

We mean to show Jeff. Davis how de Africans can fight,

As we go marching on.

We hab done wid hoein' cotton; we hab done wid hoein' corn;

We are colored Yankee soldiers now, as sure as you are born;

When de massas hear us yellin' dey'll tink it's Gabriel's horn,

As we go marching on.

Dey will hab to pay us wages—de wages of their sin;

Dey will hab to bow their foreheads to their colored kith and kin;

Dey will hab to gib us house-room, or de roof shall tumble in,

As we go marching on.

We heard de proclamation, massa hush it as he will;

De bird he sing it to us, hoppin' on de cotton hill,  
And de possum up de gum-tree he couldn't keep it still,

As he went climbing on

Dey said, "Now, colored bredren, you shall be foreber free,

From de first of January, eighteen hundred sixty-three;"

We heard it in de riber goin' rushin' to de sea,  
As it went sounding on.

Father Abraham has spoken, and de message has been sent;

De prison doors he opened, and out de pris'ners went,

To join de sable army of de "African descent,"  
As we go marching on.

Den fall in, colored bredren; you'd better do it soon;

Don't you hear de drum a-beatin' de Yankee Doodle tune?

We are wid you now dis mornin'; we'll be far away at noon,

As we go marching on.

Goodrich's Landing, La., January 18, 1864.